Spring 2019

A Comparison of Academic Outcomes in Courses Taught with Open Educational Resources and Publisher Content

Diane N. Ryan
Old Dominion University, dianenryan001@gmail.com

A COMPARISON OF ACADEMIC OUTCOMES IN COURSES TAUGHT WITH OPEN EDUCATIONAL RESOURCES AND PUBLISHER CONTENT

by

Diane N. Ryan
B.A. May 1983, Western Illinois University
M.A. August 1985, Western Illinois University

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

COMMUNITY COLLEGE LEADERSHIP

OLD DOMINION UNIVERSITY
May 2019

Approved by:

Linda Bol (Director)

Sue C. Kimmel (Member)

Monica C. Esqueda (Member)

ABSTRACT

A COMPARISON OF ACADEMIC OUTCOMES IN COURSES TAUGHT WITH OPEN EDUCATIONAL RESOURCES AND PUBLISHER CONTENT

Diane N. Ryan
Old Dominion University, 2019
Director: Dr. Linda Bol

The academic outcomes of retention, completion, persistence and final exam scores between courses taught with open educational resources (OER) and courses taught with publisher content (non-OER) were investigated in this mixed method sequential study. The perceptions and experiences of the instructors who taught the courses were also explored. The participants were 215 community college students enrolled in an online section of Introduction to Communication (CST 110), Western Civilization (HIS 111), Applied Calculus (MTH 270) or Introduction to Psychology (PSY 201). Four instructors volunteered to teach an OER section and a non-OER section within each discipline. Students were randomly divided into an OER section or non-OER section. Publishers donated the access codes for their digital content websites, thereby negating the cost for both sections. Students were compared between the OER and non-OER sections by fours measures: number of students left in the sections at the drop date, number of students who completed with a C or better, the number of students who finished the course, and the mean of the final exam scores. The four instructors were interviewed after the semester was over. The interview questions were based on the open education pedagogy COUP as the theoretical framework. The quantitative results indicated students in the OER sections retained and persisted at a significant higher rate. No significance was found in completion and the final exam scores between the OER and non-OER course sections. The interviews revealed the instructors preferred OER for quality, adaptability, student and teaching benefits. This research

lends credibility to former studies indicating higher retention and persistence rates in courses taught with OER material. Community college practitioners should make the adoption of OER course materials part of a broader initiative for student success.

This dissertation is dedicated to my husband Sean Ryan. His steadfast love and care sustained me through this journey.

ACKNOWLEDGMENTS

Thank you to Dr. Linda Bol for being gracious and enthusiastic about being the chair of my committee. With your positive outlook, constructive feedback, and continued support I feel confident in my ability to become a researcher and a practitioner. Thank you to Dr. Monica Esqueda, who was one of my first inspirational professors in the program. You willingly continued on the committee when a professional opportunity took you across the country. Thank you to Dr. Sue Kimmel for agreeing to serve on the committee because of your interest in open education resources. You took the time to get to know me. I will always be grateful to all three of you for your time, talent, and dedication to this dissertation study.

Thank you to Dr. Mitchell Williams, my program advisor, whose patience, calm manner and clear expectations made me a better writer throughout my coursework. Thank you also for sharing your wisdom about the community college industry and your words of encouragement during challenging times. Thank you to Dr. Chris Glass for coordinating and executing an effective cohort model for the CCL program. The summer institutes, the activities, the guest speakers and the administrative work you do makes the program a tremendous success.

Last but not least, thank you to the wonderful people in Cohort 14 who inspired me and uplifted me during times it was difficult to forge ahead. Because of your support, willingness to listen, and share ideas we are bonded by this experience.

TABLE OF CONTENTS

Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figures Page

CHAPTER 1

INTRODUCTION

Removing barriers to student success is one of the most important endeavors on which a community college practitioner can focus on today. Since 1975, the cost of college textbooks has outpaced inflation by more than three times (Federal Textbook Disclosure Law, 2012). Senack (2014) reported that 65% of students do not purchase a required textbook due to high prices. Those same students, however, reported that they thought that this could hurt their grade. For a majority of students at community colleges, the cost of textbooks can be prohibitive, causing them to forego purchasing the texts and putting their ability to learn the materials at risk (Wiley, Williams, DeMarte, & Hilton, 2016). On average, textbooks cost a full-time student $900 annually, based on a 2008 analysis (Hilton, Wiley, Robinson, & Ackerman, 2014). Individuals from lower socioeconomic levels are more likely to postpone college enrollment and choose a community college for affordability (Hilton et al., 2014). According to the Community College Research Center, half of community college students tend to be from the two lowest income quartiles compared with 38% of public four-year students (Bailey, Jenkins, & Leinbach, 2005).

In response to this problem, educators and non-profit foundations supported the open education movement and the creation of open educational resources (OER) (Caswell, Henson, Jensen, & Wiley, 2008). Courses taught with OER materials remove textbook cost barriers, because they are often free or low cost and students have immediate access to learning the materials. OER content includes openly licensed teaching materials that are freely available online for an instructor, student, or self-learner (McGill, 2013). Examples of OER materials include full courses, course modules, syllabi, lectures, homework assignments, quizzes, lab and classroom activities, pedagogical materials, games, simulations, and many more resources,

contained in digital media collections from around the world (Atkins, Brown, & Hammond, 2007).

In 2002, the United Nations Educational Scientific and Cultural Organization (UNESCO) convened a forum on the impact of open courseware for higher education in developing countries (United Nations Educational Scientific & Cultural Organization, 2002). At the forum, the phrase "Open Education Resources" was coined to describe their model of sharing educational materials (United Nations Educational Scientific & Cultural Organization, 2002). Open educational resources were defined as "the open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes" (United Nations Educational Scientific & Cultural Organization, 2002, p. 24). From there, the OER movement was launched with initiatives funded by the Bill and Melinda Gates Foundation, Hewlett Foundation, Carnegie Mellon, and individual governments (Hilton et al., 2014).

The development of OER in the United States was created from two movements, the massively open online course format, MOOCs, and the grant project Kaleidoscope (Bliss, Robinson, Hilton, & Wiley, 2013b). Massachusetts Institute of Technology Open Course Project, launched in 2001, is often credited as being the pioneer of the OER movement in America's higher education (Peter & Deimann, 2013). This program introduced the concept that education should be free, accessible, and open to anyone in an online format (Peter & Deimann, 2013).

The Kaleidoscope Open Course Initiative (KOCI) funded the early pioneers of OER to write open textbooks and courses to share with other teachers (Bliss, Hilton, Wiley, & Thanos, 2013a; Hilton et al., 2014). The goal of the KOCI was to eliminate textbook costs as a barrier to student success, improve the quality of course design to increase student success, and create a

collaborative community to share educational resources (Hilton et al., 2014). In the past four years, the OER community has grown exponentially by making openly licensed educational resources freely available online under intellectual property licenses, which permit their free use and repurposing. This offers opportunities for people everywhere to share, use, and reuse quality materials and tools (Jung, Sasaki, & Latchem, 2016).

Background

Benefits. Studies demonstrate that courses taught with OER materials save students money, because they do not have to purchase a textbook or access code (Hilton et al., 2013; Hilton et al., 2014; Wiley et al., 2016; Chiorescu, 2017). In addition, several studies found that students in OER courses tend to remain at a higher percentage at the tuition drop date, compared with their non-OER counterparts (Wiley et al., 2016; Hilton, Fischer, Wiley, & Williams, 2016). A study conducted by Wiley et al. (2016) calculated the tuition cost savings on OER courses, based on the students who remained at the tuition reimbursement date, which translated into more tuition revenue for the institution.

Many studies surveyed faculty members after they had taught OER materials (Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011; Bliss et al., 2013a; Bliss et al., 2013b; Hilton et al., 2013; Allen & Seaman, 2014; Belikov & Bodily, 2016). The results of these studies indicated the majority of faculty members were in favor of adopting OER, because it saved students money. Hilton et al. (2013) reported in regards to content, the majority of math instructors rated the OER math textbooks of the same or higher quality than the regular math textbooks.

One qualitative study used interviews as a data collection method with college professors after teaching one OER course in a nursing program at a university in Sweden (Elf,

Ossiannilsson, Neljesjo, & Jansson, 2015). In the study, seven educators were interviewed, and three common themes emerged. The participants described OER as a stimulating and good way of acquiring knowledge that supported flexibility and self-directed studies. There was an overwhelming amount of open materials on the Internet. Reviewing those tasks was complex, because it required preparation and time to complete (Elf et al., 2015).

Literature Gaps. Previous research has established that the creation or adoption of OER course materials can save students money and can possibly generate revenue for a community college (Hilton et al., 2013; Hilton et al., 2014; Hilton et al., 2016; Wiley et al., 2016; Chiorescu, 2017). The literature review indicates the results are mixed as whether OER materials are able to improve student retention and completion (Feldstein, Martin, Hudson, Warren, Hilton, & Wiley, 2012; Hilton & Laman, 2012; Hilton et al., 2013; Pawlyshyn, Braddlee, Casper, & Miller, 2013; Hilton et al., 2014; Hilton, Fischer, Wiley, & Williams, 2016; Wiley et al., 2016; Chiorescu, 2017; Grewe & Davis, 2017; Winitzky-Stephens & Pickavance, 2017). Several studies have used common exams to measure OER learning with different results (Lovett, Meyer, & Thille, 2008; Hilton & Laman, 2012; Hilton et al., 2013; Allen, Guzman-Alvarez, Smith, Gamage, Molinaro, & Larson, 2015). The findings of some studies reported that the instructors and teachers were generally positive about the use of OER materials (Hilton et al., 2013; Allen & Seaman, 2014; Elf et al., 2015; Belikov & Bodily, 2016; Kimmons, 2016). However, there are limited published studies and more research needs to be conducted.

This study will fill the perceived literature gap in three ways. First, the archival data were drawn from the students who were randomly placed in an OER and non-OER course section. The same instructor, the same course delivery modality, and the same semester schedule was used for OER and non-OER sections. A study with these types of parameter has not been

conducted before to analyze drop, completion, and persistence rates in OER and non-OER courses. Second, few studies have used the qualitative method of interviews to elicit faculty members' perceptions and experiences of teaching OER content materials, compared with teaching publisher content. Third, using a common final exam in a one-semester period has only been studied once before (Chiorescu, 2017).

Conceptual Framework

The conceptual framework COUP guided the study. COUP is an acronym for cost, outcomes, usage, and perceptions. The COUP framework is the Open Education Group's approach to studying the effects of open educational resources and open pedagogy in secondary and post-secondary education (Bliss et al., 2013b). Cost is defined as student cost or tuition revenue; outcome is student retention and completion rates; usage is the permissions provided by open licenses; and perception concerns what faculty and students think and feel about OER (Bliss et al., 2013b).

Purpose Statement

The purpose of the study was to understand whether the use of OER course materials improved student drop, completion, and persistence rates, compared with the same course taught using non-OER course materials when eliminating cost and accounting for volunteer bias. Additionally, the study also seeks to gain insights into the perceptions and the experiences of the instructors who teach an OER and a non-OER course within the same semester. Student data from four disciplines taught in online courses (Applied Calculus, Introduction to Psychology, Western Civilization, and Introduction to Communication) was analyzed. In order to equalize the two groups, the non-OER students were provided with free publisher course access codes. To date, no other OER study has controlled for cost savings in the OER course and publisher course.

By removing the cost, the researcher tried to determine whether the students would continue retaining at high attendance rate and complete the OER courses. To attempt to control for instructor bias, the same instructor taught both the OER and non-OER sections. At the end of the semester, both sections were completed by a common final exam. The results of the study focused on presenting the findings concerning student retention, completion, and persistence. In addition, the study examined the average final exam score between the OER and non-OER sections in each discipline to measure learning. The last part of the study analyzed feedback from the instructors about their experiences of teaching a course using OER content versus using publisher content. The study examined what happens when course material costs are removed and OER goes head-to-head with publisher content within four course disciplines.

Research Questions

Previous research has indicated there is a significant difference between the use of OER course content material and higher retention and completion rates when comparing OER courses with non-OER courses favoring OER (Feldstein et al., 2012; Hilton et al., 2016; Wiley et al., 2016; Chiorescu, 2017). However, only in the Chiorescu (2017) study did the same instructor teach the OER and non-OER courses. In the other studies, the courses were not taught in the same semester or did not use the same delivery modality (Feldstein et al., 2012; Hilton et al., 2016; Wiley et al., 2016). The first three research questions compared student drop, success, and persistence rates between each course taught using OER with the course taught using the publisher content. The fourth research question focused on the scores of the common final exams. This question was designed to understand whether there is a difference in the final exam scores between the OER and non-OER courses to measure learning. The fifth research question focused on the qualitative portion of the study gaging faculty perceptions and experiences

teaching with both types of material during the same semester.

The study was guided by the following research questions:

1. Is there a significant difference in retention rate at the tuition drop date between the students in the OER online courses and the students in the non-OER online courses?
2. Is there a significant difference in successful course completion rates between the students in the OER online courses and the students in the non-OER online courses? (Successful course completion will be determined by the final Grade C or higher. Hilton et al. (2016) and Wiley et al. (2016) consider successful completion of Grade C or higher in OER studies because of credit transferability.)
3. Is there a significant difference in persistence rate between the students in the OER online courses and the students in the non-OER online courses?
4. Is there a significant difference in exam scores between the students in the OER online courses and the students in the non-OER online courses within each discipline?
5. What are the perceptions and experiences of the instructors who taught the OER and non-OER course materials during the same semester?

Professional and Scholarly Significance

The educational value and quality of OER course content material has not been extensively explored in a one-to-one comparison research study between OER and non-OER. Researchers call for OER efficacy research to have stronger design with students randomly assigned to courses with OER and non-OER materials (Hilton et al., 2016; Winitzky-Stephens & Pickavance, 2017).

A majority of community college students face financial hardships, such as rising tuition fees, commuter costs, and textbook prices (Senack, 2014). Community college leaders are concerned about the financial burden students are experiencing and are encouraged to seek innovative ways to help them overcome them (Phelan, 2016). In an effort to reduce the cost of attendance, college administrators are encouraging the use of OER as a valid alternative to costly textbooks or access codes (VCCS Re-engineering Task Force II, 2013).

Much of the prior research has also been unable to account for instructor bias, course delivery modality, and the cost of publisher material, which may influence the measurement of OER retention and completion. If student, retention and completion rates are higher or the same for OER content material, compared with publisher content material, the argument can be strengthened to organize more OER classes. OER studies can go beyond the initial findings of cost savings and completion to examine if course design is a factor in student retention and success. If student retention and completion rates were higher for students in the publisher content courses, additional studies can be designed to determine the rationale for both. The results of the qualitative data from interviewing the four instructors provided information to identify what obstacles the faculty need to overcome in order to teach OER materials. Qualitative analysis of the faculty members' perceptions and experiences of teaching OER and publisher content materials may help identify the additional methods for increasing success in community college students.

Overview of the Methodology

This mixed-methods research study used data from one large community college with multiple campuses in the Virginia Community College System (VCCS). The quantitative part of the study used archival data from eight online courses in four disciplines: Applied Calculus,

Introduction to Communication, Introduction to Psychology, and Western Civilization. Archival data were obtained from 215 students. The students were registered in one of the four online course sections (Applied Calculus, Introduction to Communication, Principles of Psychology, and Western Civilization). Once the course section of each discipline reached maximum enrollment, the students were randomly divided into an OER or non-OER section. One faculty member taught both OER and non-OER sections of each discipline for eight online courses, taught by four faculty members.

Institutional data were requested to measure student retention at the drop/delete date, which is ten days after the semester begins. Successful student completion was measured by the final Grade C or higher at the end of the semester. Persistence was measured by the number of students who enrolled compared to the number of students who finished. A comparison was made between the numbers of "completers" in the OER classes with the number of students in the non-OER courses. The comprehensive final exam scores for the OER and non-OER sections were also requested. Analysis was conducted using descriptive and inferential statistics comparing the differences in the number of the students who remained, completed, or persisted by percentage. The data from all the course disciplines from the eight online sections (four OER sections and four non-OER) were aggregated, and a z test of proportions was run to test for significance.

The qualitative portion of the study used semi-structured interviews with the four faculty members who taught both the OER and non-OER sections within the discipline. Qualitative inquiry contributes to understanding the meaning, context, process, and causal explanations for participants in the study (Hayes & Singh, 2012). According to Hayes and Singh (2012), an important component of qualitative research is "the focus on the connection between researcher

and the theoretical framework" (p. 32). A significant part of the connection is the sensitizing concepts. Sensitizing concepts are ideas organized to guide the research, which focus on concept exploration (Faulkner, 2009). The study will focus on concept exploration, since comparing teaching with OER and non-OER during the same semester is a relatively new phenomenon in OER research. With concept exploration, the researcher studies participants' experiences using their words, which is the research tradition of phenomenology (Hays & Singh, 2012). Conducting individual interviews is the best way of gathering data from the faculty members for the final research question.

Summary

The history of OER in America's higher education system is relatively new. The majority of the OER material creation and adoption are from community college faculty (Hilton, 2016). Hilton's (2016) research[.1] established the use of OER course material saves students money, although the results are mixed when it comes to determining whether OER improves student drop, withdrawal, or success rates. This researcher hopes the study will be a "harm-free" study, meaning the OER findings did not hurt student retention, completion, or persistence. The limitations in previous OER versus non-OER studies used student data from different semesters, and different instructors taught the OER and non-OER courses, using different course delivery modality. In addition, students were not randomized (Feldstein et al., 2012; Hilton & Laman, 2012; Hilton et al., 2013; Pawlyshyn, 2013; Hilton et al., 2014; Hilton et al., 2016; Wiley et al., 2016, Chiorescu, 2017). This study attempted to address previous limitations by removing costs for both groups, using data from randomized students, and the same faculty members teaching both types of course. Furthermore, the instructors' interviews added useful insights and perspectives to teaching and learning with OER versus non-OER.

CHAPTER 2

LITERATURE REVIEW

Previous research focused on reporting courses taught with open educational resources helped students save money. Hilton, Gaudet, Clark, Robinson, and Wiley (2013) examined OER cost savings for math courses at a community college in Arizona. The average price of the math textbook was estimated at $125. The researchers assumed by using the openly licensed math material in one semester, if all the students purchased a textbook, the potential cost savings would reach $255,375. In a similar study, using an average textbook cost of $90.61, aggregated between seven community colleges and the 10 courses, students in the OER courses had a potential cost savings of $338,337.74. Students in the non-OER courses had a potential cost spending of $906,462.44 (Hilton, Wiley, Robinson, & Ackerman, 2014). Chiorescu (2017) also found the cost savings of 159 students who used the OER college algebra textbook for one semester were $13,685.

Hilton et al. (2014) concluded open educational resources have the potential to save students, parents, and taxpayers a significant amount of money. The broad adoption of OER can have a financial impact. Specifically, the authors stated thus:

> If these savings were realized by only 5% of the 20,994,113 students in the United States who enrolled in college during the 2011 fall semester (National Center for Education Statistics, 2013), the total cost savings would be approximately one billion dollars per year (p. 81).

While it is established, the use of OER course materials can help students save money, very little research exists comparing drop, success, and persistence rates as well as final exam scores in OER and non-OER courses using randomized groups of students. In this chapter, the researcher reviewed the relevant literature on drop, completion, and persistence rates, final exam scores in OER and non-OER courses, and faculty perceptions of teaching OER. Because the

quantitative data for the study were collected from online courses, a review of the literature on online access, student retention, and completion for community college students is included.

Drop Rates Compared in OER and non-OER Courses

Two studies compared the drop rates of OER and non-OER courses in a pilot program of a business administration degree at a community college. Named the Z-Degree, the faculty developed 21 courses within the Associate of Science degree in Business Administration with OER material, thereby eliminating textbook costs for students. After the first year of the pilot program, Wiley, Williams, DeMarte, and Hilton (2016) investigated if adopting OER led to lower student drop rate of the course at the tuition reimbursement date. In the fall semester of 2013, 303 students enrolled in OER courses. Another 12,574 students enrolled in non-OER sections of those same courses. At the drop date (10 days into the semester), 8 students dropped from the OER sections and 468 students dropped from the non-OER sections. A *z* test of the proportions confirmed the difference in drop rates was significant. In the spring semester of 2014, 450 students enrolled in the OER courses, and 10,658 students enrolled in non-OER sections of the same courses. At the drop date, 13 students dropped from the OER sections, and 362 students from the non-OER sections. Again, a *z* test of proportions confirmed the difference in drop rates was significant favoring OER.

After the two-year Z-Degree pilot program was complete, Hilton, Fischer, Wiley, and Williams (2016) examined the drop rates between the OER and non-OER courses, while at the same time factoring in course delivery modality. The results indicated no significant differences between the drop rates of OER and non-OER face-to-face courses. However, for online/hybrid courses, there was a significant difference of lower drop rates favoring OER sections. The

researchers did not discuss the possible reasons for the differences between the face-to-face and the online sections.

Several limitations existed in the studies. A special section number with a Z in it to designate zero costs identified the OER courses. Students could have self-selected those classes knowing there would be no textbook cost. There was no way to determine if students dropped out of a non-OER course and reenrolled in an OER course before the drop date. The faculty in the pilot program volunteered and they might be different from the faculty in the non-OER courses. There was no way to account for the instructor's effect on student learning.

Success Rates Compared in OER and non-OER Courses

The terms success rate and completion rate are synonymous. Prior research studies have examined success rates when comparing OER and non-OER courses, with results favoring OER courses. Hilton and Laman (2012) measured success rates as the final grade point average for students using the open psychology textbook, compared with the students who used the traditional textbooks. The results indicated in the open textbook courses, the students' grade point average was .40-percentage point higher than the traditional textbook class. Feldstein et al.'s (2012) results indicated students in the OER business courses had significantly higher grades as compared to the students in the other courses.

In a larger study involving the Kaleidoscope project, Pawlyshyn, Braddlee, Casper, and Miller (2013) compared the OER and non-OER success rates for reading in a critical inquiry course and math course. When analyzing the OER and non-OER course sections for the critical inquiry course, the researchers found success rates were higher in the courses taught by the faculty who utilized the OER. In the math course, students in the OER sections were taught with My Open Math (MOM)—an open access online learning platform. The community college math

faculty reported a nearly 10% reduction in course failures using MOM. When comparing the students who did not use MOM (spring of 2011) and the students who did use MOM (fall of 2012), the math pass rate increased by 20%.

There are additional studies indicating a significant difference in success between OER and non-OER courses. Hilton et al.'s (2016) analysis of the Z-Degree success rates indicated students in hybrid/online OER courses, compared with students in non-OER courses, were more likely to receive a C or higher as a final grade. The researchers stated, "The success rate of students in the distance Z courses was nearly 6% higher than those in the distance non-Z courses" (p. 24). Chiorescu (2017) explored the use of OER in college algebra courses, using a publisher textbook compared with an OER textbook. In the spring of 2015, the researcher taught the algebra courses with a low-cost OER textbook. She then compared completion with Grade C or higher from students enrolled in spring 2015 to non-OER semesters of spring 2014, fall 2014, and fall 2015. The results indicated the students completed at a significantly, albeit slightly, higher rate in the spring of 2015 compared with the other three semesters.

In comparing OER and non-OER, one study claimed there was no difference in or a negative impact on success rates. Hilton et al. (2013) analyzed student success rates in OER and non-OER math courses taught at a community college. The results indicated there were no significant changes in student success rates from 2011 to 2012 except for one case. The student success rate of Introductory Algebra declined from 67% in 2011 to 51% in 2012.

A study comparing OER and non-OER outcomes on student success rates of 14 general education courses at a community college found no differences between the courses for continuing students (Winitzky-Stephens & Pickavance, 2017). Student success was defined as course grade (C or higher), pass/fail (developmental courses), or withdrawal. Using a multilevel

modeling approach, OER did not appear as a significant parameter for any of the three success factors. The results suggested the course-level and student-level variables were more indicative of student success (Winitzky-Stephens & Pickavance, 2017).

The previous research studies on success rates have limitations. No test for significance was conducted in Hilton and Laman (2012) and Pawlyshyn et al. (2013), which affects the validity of the results. The limitations of Hilton et al.'s (2016) study included the disparity of sample sizes in the enrollment of Z and non-Z courses, excluded accounting for faculty influence on the courses, and excluded data on student groups, indicating the two sets of courses were equivalent. Chiorescu (2017) compared one semester of OER data with three previous semesters of publisher content data, which illustrates a disparity in sample sizes. The math placement test was changed between semester of the non-OER and OER study, which could account for the drop in success rate for the OER Introductory to Algebra class (Hilton et al., 2013). Due to the change in the placement test, the students who were previously unable to be placed in the course were allowed to do so. Winitzky-Stephens and Pickavance (2017) multi-level modeling analysis of OER versus non-OER in fourteen general education courses did not account for course modality.

Persistence Rates and Community College Students

The majority of OER research focuses on successful completion of a course with Grade C or higher. The definition of persistence and retention intertwine in community college research. In this study, persistence is defined as the percentage of the students who completed a course, compared with the number of the students who enrolled in the course. The definition is an adaptation of Successful Course Completion Ration (SCCR), designed by retention expert Hagedorn (2006). The SCCR definition is the "percentage of courses that a student completes as

compared to the number of courses the student enrolls" (p. 13). One benefit of SCCR is it takes into account not all students attend community college to earn a certificate or degree. The formula assumes students intend to complete their courses and gives the institution the opportunity to measure student persistence against a clearly defined and widely accepted goal (Hagedorn, 2006). Using an adaptation of the formula in this study to measure persistence in OER courses and non-OER courses allowed the researcher to account for all the students who had enrolled in and completed a course, not just the ones who had successfully completed with Grade C or higher.

To date, the researcher found one OER study analyzing student persistence in the form of student achievement. Grewe and Davis (2017) found the use of OER course materials was a significant predictor of student achievement in online history courses over two semesters at a community college. Student achievement was measured by assigning numbers to final course grades, A = 4, B = 3, C = 2, D = 1, F = 0, and withdrawal = 0. Therefore, the study did account for the students who persisted in the courses and finished with a D. However, the study did not attempt to account for teacher effect and other student variables contributing to success.

Previous research demonstrated the courses offering OER materials saved students money. Several studies link community college persistence to financial factors, which students may face while in school. Nakajma, Dembo, and Mossler (2012) examined a variety of variables affecting persistence for the community college student. One of the variables focused on financial aspects, receipt of financial aid, off-campus work hours, and total work hours. The study surveyed 415 community college students and tracked them from the fall semester to the spring semester, thereby measuring fall to spring persistence. Although the largest predictor of persistence was the student's overall GPA, the results found significant results for the financial

variables and their influence on student persistence. The study compared the students who received financial aid with those who did not and found 12% more students with financial aid persisted at a higher rate. The students who worked fewer hours off campus persisted at a higher rate than the students who worked more hours off campus. The number of total work hours for students was negatively correlated with persistence (Nakajama et al., 2012).

In a study on college selection and persistence of Black and Latino males in community colleges, financial aid access and low expenses at the college were found to be integral to persistence (Wood & Harris, 2015). The study defined low expenses at the colleges as the students' access to a part-time campus job and low living expenses. These factors were positive predictors of their persistence (Wood & Harris, 2015).

Chan and Wang (2017) studied 1,168 STEM students at a community college to analyze momentum and persistence through course completion. Forty percent of the students did not complete the first semester courses and did not return to the college the following semester. Academic readiness was the principal factor contributing to this loss, but the researchers also attributed it to financial reasons self-reported by the students (Chang & Wang, 2017). These studies are important because OER materials remove the cost barrier for students, further solidifying a possible connection between OER and persistence.

Exam Scores Compared in OER and non-OER Courses

Comparing common exam or test scores is also a measurement used in previous research studies to test student learning between OER and non-OER course sections. Hilton and Laman (2012) compared the students' scores on a common final exam between different semesters, teaching Introduction to Psychology with an open textbook versus a publisher textbook. Students from both types of courses took a departmental final exam, and the students who used the open

textbook increased their final scores by 3.5 points (Hilton and Laman, 2012). Students in Pawlyshyn et al. (2013) also found the exam scores in the OER math courses as part of the Kaleidoscope Project were higher than the non-OER courses.

Several studies factored in common exam or test scores in OER efficacy and found no significance. Lovett, Meyer, and Thille (2008) analyzed OER use in statistics courses through the Open Learning Initiative (OLI). Both online and face-to-face sections were examined with a sample size of 69 students. The primary measure of student learning outcomes involved their scores on the exam. The exam, Comprehensive Assessment of Outcomes, in a first statistics course was designed to measure students' basic statistical reasoning. Comparing results over the fall of 2005 with traditional materials and the spring of 2006 with OER materials, the results indicated there was no significant difference for students. Lovett et al. (2008) described the results to indicate OER materials "do no harm" because students performed the same in the OER course as in the traditional course (p. 10).

Allen, Guzman-Alvarez, Smith, Gamage, Molinaro, and Larsen (2015) utilized OER in the form of ChemWiki to test its effectiveness in learning versus publisher content material. Two general chemistry courses were compared over one semester. Student performance was measured using common midterm, final, and pre-/post-exams. The results indicated there were no significant differences in the performance of the students in the ChemWiki and textbook sections on the scores from post-test, midterm, final exam, or course grades. The researchers called for more use of and studies into ChemWiki, because it provides a unique platform for learning due to its flexibility for new and innovative instructional techniques. Similar to Lovett et al.'s (2008) study, Hilton et al.'s (2013) research was also a "do no harm" study because of using the OER course materials.

The OER and non-OER studies analyzing common exam scores have several limitations. Two of the studies did not test for significance (Hilton & Laman, 2012; Pawlyshyn et al., 2013), even though they found favorable results in the OER course sections. The researchers did not state why significance was not conducted. Lovett et al.'s (2008) study of online OER and non-OER statistics courses used a different semester schedule and different instructors. Allen et al. (2015) conducted the ChemWiki experiment in the final quarter of a three-quarter sequence in general chemistry. The researchers did not state what course materials the students used in the first two quarters.

Faculty Perceptions of Teaching OER or Publisher Content

Research Question 5 focused on the instructors' perceptions and experiences of teaching OER and publisher content material at the same time. The OER academic community has explored faculty members' perceptions and thoughts about teaching OER content. To date, the researcher has been unable to find a study specifically focused on the use of publisher content material.

The majority of research on faculty perceptions of teaching OER course materials was conducted through questionnaires. Petrides, Jimes, Middleton-Detzner, Walling, and Weiss (2011) analyzed the surveys of 31 instructors who utilized OER through an open statistics textbook. The instructors reported they adopted the open textbook primarily because of concerns about textbook costs for students.

Two studies indicated no differences between the textbooks. Hilton et al.'s (2013) study of OER math courses involved 42 faculty members. Of the twenty instructors who completed the survey, three instructors rated the OER math book worse than the regular textbook; nine instructors made similar comments and two reported higher quality than regular textbooks. Bliss,

Hilton, Wiley, and Thanos (2013a), who examined faculty perceptions of OER adoption in seven institutions involved in the Kaleidoscope Project, reported similar results. In the first study, Bliss et al. (2013a) surveyed eleven instructors. Seven of the instructors reported they believed the students were equally prepared when traditional textbooks were replaced with OER textbooks. Three faculty members felt the students were more prepared, and one thought students were less prepared.

In an extended study, Bliss, Robinson, Hilton, and Wiley (2013b) analyzed faculty perceptions in an additional eight colleges involved in the Kaleidoscope Project. In the second study, 58 faculty members were surveyed. The researchers found 55% of the instructors reported the open materials were of the same quality as the publisher content and 35% thought they were better. The instructors also reported they were willing to adopt OER, because of the low or no cost to the student and the possibility of making changes to the course materials.

Utilizing a large sample size, Allen and Seaman (2014) surveyed 2144 college professors, soliciting their opinions about OER. Of the 729 faculty who responded, 61.5% said the OER materials had about the same quality as the traditional content, 26.3% thought the traditional resources were superior, and 12.1% regarded OER as superior. In terms of efficacy, 68.2% said proven efficacy was about the same, 16.5% stated OER had superior efficacy, and 15.3% claimed the publisher content was superior (Hilton, 2016). In general, the majority of the faculty believed the OER course materials were as good as or better than the traditional textbooks.

Four qualitative studies on instructors' perceptions and experiences of OER or Open Educational Practices (OEP) have been conducted. Elf, Ossiannilsson, Neljesjo, and Jansson (2015) showed overall, the students and faculty had positive perceptions and experiences of

using OER in the department of nursing at a university in Sweden. Seven educators were interviewed after teaching a clinical practice course, developed using OER material. The focus of the course was basic patient needs and contained theoretical and clinical elements. Content analysis was used to study the recorded answers from the interviews and the open questions in the survey. From the analysis, two thematic categories emerged. First, OER is a stimulating and good way of acquiring knowledge supporting flexibility and self-directed studies. Second, there is an overwhelming amount of OER material on the Internet, and it is a complex task to appraise the resources. A complex task requires preparation, time, and appropriate skills to manage (p. 257). Elf et al. (2015) called for more OER exploration, with an increasing need for students to be trained in digital literacy.

Kimmons (2016) explored the use of OER for course creation and sharing in the classroom with K–12 teachers. The purpose of the study was to gain an understanding of how teachers who have been introduced to OER perceive its major potentials and barriers. The study was a mixed-methods design of analyzing frequency of responses and categorizing data from the questionnaire responses. Teachers were trained for three days on OER material, specific to their grade level and discipline. Time for networking and collaborating with the other teachers was also built into the training. The findings were organized into three categories: "What are the most important potentials of openness? What are the most severe barriers to openness? Are these perceived potentials and barriers influenced by other factors?" (p. 13). The qualitative results explored pedagogical, economic, and professional potentials and large and small personal barriers. The participants shared a collective voice on potential benefits and major barriers. The potential benefits reported were opportunities for teachers' choice to improve access to educational materials, increase collaboration between colleagues, and connecting the classroom

to the outside world. The major barriers identified were lack of legislative support, lack of quality OER material, time for personal planning, and time for collaboration to create or share resources, technology infrastructure, professional development opportunities, and community buy-in (Kimmons, 2016).

Belikov and Bodily (2016) qualitatively analyzed 218 faculty responses in reference to OER. The findings indicated the most frequent response involved the faculty's need for more information on OER. Specifically, the faculty wanted to know how to release their own material under open license and where to find reliable OER materials. The majority of the faculty also reported a general lack of awareness and understanding about OER. The faculty also expressed the need for institutional support for OER evaluation and adoption.

Through semi-structured interviews, Cronin (2017) studied the higher education faculty perceptions of open educational practices (OEPs). Open educational practices included the use of OER, open pedagogies, and the open sharing of teaching. Over a four-month period, 19 faculty members were interviewed about participating or not participating in OEPs. Several themes emerged. The faculty who used OEPs, tended to balance privacy and openness, develop digital literacies, value social learning, and challenge traditional teaching roles. The faculty members who did not practice OEPs did not have a strong awareness or express value of OEPs.

Online Courses and Student Access, Retention, and Completion

The course modality for the study is online asynchronous delivery, because the four instructors who volunteered for the study preferred to teach online. Hilton et al.'s (2016) study of the OER courses, delivered in online modality, had significant lower drop rates and higher success rates than the non-OER courses. Therefore, this section of the literature review presents the studies on access, retention, and completion rate for online community college students.

Online courses offer the opportunity for a major increase in access to college education (Huntington-Klein, Cowan, & Goldhaber, 2017). In 2012, more than 6.7 million college students were enrolled in a traditional credit bearing online class, the majority of whom attended a community college (Shea & Bidjerano, 2016). Online education has been viewed as a catalyst for democratization, and increased access has been adopted broadly by community college because of their open access mission (Huntington-Klein, Cowan, & Goldhaber, 2017; Shea & Bidjerano, 2016).

Johnson and Berge (2012) have stated three important factors must be in place in order for community college online classes to be successful: (a) the likelihood of student success and support to maximize success, (b) professional development for the faculty who intend to switch to online learning, and (c) the support of administration to help streamline the transition. In order for students to be successful in the online learning environment, they need to have the habits and characteristics of adult learners. Online learners need to be autonomous, self-directed, and goal oriented (Bol & Garner, 2011; Johnson & Berge, 2012). This can be difficult for community college students, because faculty often report they have to help students adjust to becoming a college student. Students do not often come to college from high school with the skill set of an adult learner.

The Aragon and Johnson's (2008) study of 305 students from a rural community college focused on what factors may cause community college students to be completers or non-completers in online courses. Factors in the study included demographic traits, hours enrolled, academic readiness, and self-directed learning characteristics. Age, gender, ethnicity, grade point average, and financial aid eligibility were included in the demographic traits. As for the demographic variables, no significant results were found for age, completers, and non-

completers. A significant relationship was found between gender and completion, with a higher rate of completion for females. No significant relationship was found between ethnicity, completers, and non-completers, and no significant relationship was found between financial aid eligibility, completers, and non-completers. The results indicated the completers tended to enroll in more online classes than the non-completers did. No significant relationship was found between the level of academic readiness (the students who were placed in developmental reading, writing, or math), completers, and non-completers. The completers of online courses had higher grade point averages as compared to the non-completers. The Bartlett-Kortrijk Inventory of Self-Learning was used to measure self-directed readiness. The study did not find any significant relationship between the students' scores on the inventory and whether they to completed the course or not (Argon & Johnson, 2008).

The researchers made three attempts with phone calls to try to discover the reasons why the 116 students did not complete the online course. Their efforts gained responses from 65 non-completers. The students gave the following reasons for not completing the course: personal/time (34%), course design and communication (28%), technology/WebCT tutorial (18%), and institutional issues (11%). Argon and Johnson (2008) called for online student services to help students with technology issues. In addition, they also emphasized the need for professional development for online instructors to follow course design principles and an institutional policy for online quality control measures and course development.

Xu and Jaggars (2011) researched two outcomes for online gatekeeper courses ENG 111 and math courses based on a data set obtained from the Virginia Community College System (VCCS). The first outcome was the mid-semester course withdrawal rate, also known as attrition,

and the second was the likelihood of earning Grade C or higher. Data were from the fall of 2004 through the summer of 2008. The students were tracked for four years.

The results indicated online instruction in key introductory college level courses was typically not as effective in terms of attrition and completing a course with Grade C or higher, when compared with face-to-face courses. Online English gatekeeper courses had an attrition rate of 19% and the rate of face-to-face courses was 10%, illustrating a gap of 9%. Online math gatekeeper courses had an attrition rate of 25%, and the rate of face-to-face courses was 12%, illustrating a gap of 13%. Of the students who persisted to the end of the online English courses, 74% earned Grade C or above for English and 67% for math. The percentage of students in the face-to-face English course who persisted with Grade C or higher was 77% and, in math, it was 73% (Xu & Jaggars, 2011).

Several important points were discussed in this study. High online withdrawal rates may not be due to course format but the self-selection bias of the students. The type of student who enrolls in an online course may be the type of student who is more likely to withdraw. In addition, the study did not take into account the reasons why students may withdraw. The study did not compare the drop rate for deleted students at the tuition reimbursement date. The results showed the English and math online students tended to be old, White, career-technical focused, English speaking, and have lower credit loads for the semester. Previously, the dual enrolled the students who did not have to take remedial courses were also likely to choose an online course. The authors concluded with a call for institutions to put more emphasis on developing and evaluating programs and practices to improve students' retention and learning in the online classroom.

Xu and Jaggars (2013) conducted another study examining two outcomes of online learning with data from 34 two-year public community and technical colleges in the State of Washington. The students who were on an academic transfer-orientated path ($N = 22,624$) were tracked from the fall of 2004 through 2009. The aim of the study was to assess the effect of persistence and final course grade between taking an online course and a face-to-face course. The study also examined predictor variables for students taking an online course, such as the demographics and the distance from a student's home to a college. Data did not include drop rates for tuition reimbursement at the beginning of the semesters.

The results of Xu & Jaggars' (2013) study suggested the online course format had a significantly negative relationship with both course persistence and course grade. The overall rate of online course persistence was 3.6 percentage points lower in the face-to-face course. For the students who persisted through the online course, the average grade was .19 points lower than in the face-to-face course. Washington's two-year systems serve a proportionally higher white population and lower financial aid population than the national average, leading the authors to suggest the gaps between the online and face-to-face outcomes may be strong among the less-advantaged populations, particularly among the ethnic minorities and students with below-average prior GPA (Xu & Jaggars, 2013).

A national study of the differences between online and classroom-only community college students found some promising results for degree attainment for online students (Shea & Bidjerano, 2016). Data were obtained from the Department of Education. The study tracked 4400 students over a six-year period and found the students who enrolled in online classes completed degree attainment at a higher level than the students who studied in traditional face-to-face classes. The number of the students who took online classes and transferred the degree

attainment rate was higher than the students who took face-to-face courses over the six-year period (Shea & Bidjerano, 2016). However, in a similar study with a larger sample population from the Washington State Community College System, the results showed the students who took online courses were less likely to graduate with a degree than students who took traditional courses at a significant lower rate (Huntington-Klein, Cowan, & Goldhaber, 2017).

The studies examining online courses and student retention and completion rates have several limitations. Aragon and Johnson's (2008) study of demographic factors for online completion was a one semester "snap shot" at one Midwestern community college (p. 156). The researchers called for a longitudinal study with multiple community colleges and suggested the qualitative component of the study be expanded. Xu and Jaggars' (2011) study examined the online course completion rate at 23 community colleges in Virginia. A significant limitation was each college in the system had developed their own online courses, leaving limited course consistency in the programs. In addition, there was no attempt to find out why students had dropped out of the courses. Xu and Jaggars' (2013) study into online courses in Washington's 34 community college system noted the results might not be generalizable because the system's student population tended to be Caucasian with middle income and each college's philosophy of course design and support was different. Although Shea and Bidjerano (2017) found promising results for the degree attainment of the students who took online courses, the researchers noted the scope of the study was limited and there could be other student factors contributing to the success of online courses and degree attainment.

Summary

Previous research indicates student retention rate in OER courses is not consistent. Hilton and Laman's (2012) study into the use of an open psychology textbook at a Houston Community

College showed the likelihood of student retention in courses with open textbook was higher than for the students who had used a publisher textbook in the previous semester. Wiley et al. (2016) found a significant number of students in the OER courses remained at the drop date than the students in the non-OER courses. An additional study on a community college's Z-Degree, comparing Z-courses with their non-Z counterpart courses, found the students in Z-courses remained at a higher rate at the drop date (Hilton et al. 2016).

Completion is often defined as involving finishing the course with a final Grade C or higher (Hilton et al., 2016; Hilton et al., 2013). The study of math courses at Scottsdale Community College found there was no significant change in final math scores between the OER and non-OER courses (Hilton et al., 2013). The students' final grades in the OER college algebra class decreased significantly compared with the non-OER course (Hilton et al., 2013). One community college's Z-degree study indicated the students had statistically significant higher rates of completing hybrid/online Z-courses, compared with their non-Z counterparts (Hilton et al., 2016). Similarly, Grewe and Davis (2017) found students persisted in the OER courses at a significantly higher rate than the non-OER ones. However, Winitzky-Stephens and Pickavance (2017) found no significant effect on student success for OER courses with continuing students, although they reported some positive effects for OER with new students. Appendix A presents a summary of the quantitative OER research studies and their results.

Concerning retention, completion, and persistence rates for online courses in community colleges, research indicates the rates tend to be lower than face-to-face classes (Aragon & Johnson, 2008; Xu & Jaggars, 2011; Xu & Jaggars, 2013). A four-year study of online gatekeeper courses within the Virginia Community College System showed, between the drop date and withdrawal date, the attritions rates were almost twice as high when compared with the

face-to-face courses (Xu & Jaggars, 2011). Completion rates in online courses were also significantly lower in the online courses (Xu & Jaggars, 2011). A significant negative relationship with course persistence and course grade was found in a study of Washington State's community college system online courses (Xu & Jaggars, 2013). All of the researchers in these studies called for stronger course design to improve student learning (Aragon & Johnson, 2008; Xu & Jaggars, 2011; Xu & Jaggars, 2013). Instructional design is a feature of OER courses, because they are built using a backward design process. OER courses are mapped out, meaning the course learning outcomes are aligned to the course material, the assignments, and the assessments (Wilson & McTighe, 2011).

Two qualitative studies indicated openness in practice has potential for teaching and learning (Elf et al., 2015; Kimmons, 2016). Other studies indicate OER awareness and understanding need to be developed (Belikov & Bodily, 2016; Cronin, 2017). More qualitative and in-depth research needs to be conducted with the faculty who teach OER material.

The literature review reveals the results as to whether OER materials can improve student retention, completion, and exam scores are mixed, and more research needs to be conducted. Hilton (2016) recommends future OER efficacy research needs to have stronger design, with students randomly assigned to courses with OER and non-OER materials.

CHAPTER 3

METHODOLOGY

In a mixed-methods study, the quantitative approach may use descriptive and inferential statistics to analyze numerical data (Leedy & Ormond, 2016). The qualitative approach may use interviews to illustrate or clarify quantitative findings or to gain insights into the participants' experiences (Hayes & Singh, 2012). Roberts endorsed (2010, p. 145) both approaches claiming thus:

> Although qualitative and quantitative approaches are grounded in different paradigms, it is possible to combine them into one study. The mixed-methods approach is expanding as a viable methodology in the social and human sciences, evidenced by a variety of books and journals reporting and promoting mixed-methods research.

Specifically, this study had a mixed-methods sequential explanatory design, because the quantitative data were collected first, followed by the qualitative data. This allowed the instructors to provide additional explanation about the results of the quantitative results (Creswell, 2013).

The first three research questions of the study compared student drop, success, and persistence rates between each course taught using OER with the course taught using the publisher content. The fourth research question of the study focused on the scores of the common final exams. This question was designed to measure learning between the OER and non-OER courses based on a common final exam. Question 5 addressed the qualitative nature of the study concerning faculty perceptions and experiences of teaching both types of material during the same semester.

More specifically, the following research questions were addressed:

1. Is there a significant difference in retention rate at the tuition drop date between the students in the OER online courses and students in the non-OER online courses?

2. Is there a significant difference in successful course completion rates between the students in the OER online courses and the students in the non-OER online courses? (Successful course completion will be determined by the final Grade C or higher. Hilton et al. (2016) and Wiley et al. (2016) consider successful completion of Grade C or higher in OER studies because of credit transferability.)
3. Is there a significant difference in persistence rate between the students in the OER online courses and the students in the non-OER online courses?
4. Is there a significant difference in exam scores between the students in the OER online courses and the students in the non-OER online courses within each discipline?
5. What are the perceptions and experiences of the instructors who taught the OER and non-OER course materials during the same semester?

Research Design

Quantitative research analysis was used to measure the first four research questions of the study. A comparison was conducted between the OER and the non-OER course sections in each discipline to determine if there is a significant difference between students' drop rate at the tuition reimbursement date, successful completion rate as measured by a final Grade C or higher, and persistence rate. The comparison of drop, success, and persistence rates or some form of them has been used in the previous studies to attempt to measure OER efficacy (Hilton & Laman, 2012; Feldstein, Martin, Hudson, Warren, Hilton, & Wiley, 2012; Pawlyshyn, Braddlee, Casper, & Miller, 2013; Hilton, Gaudet, Clark, Robinson, & Wiley, 2013; Hilton et al., 2016; Wiley et al., 2016; Chiorescu, 2017; Grewe & Davis, 2017).

Previous research studies have also used common exam or test scores as a design to test the differences between the OER and non-OER course sections. Two studies found common

exam scores favored the OER sections, although it did not test or discuss their significance (Hilton & Laman, 2012; Pawlyshyn et al., 2013). Four other studies factored in common exam or test scores and found no significance (Lovett, Meyer, & Thille, 2008; Bowen, Chingos, Lack, & Nygren, 2012; Hilton et al., 2013; Allen, Guzman-Alvarez, Molinaro, & Larsen, 2015).

Qualitative research methods were used to address research question 5. An interview was conducted with each instructor who taught the OER and non-OER sections. Previous research about faculty perceptions of using the OER course materials was primarily conducted through questionnaires (Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011; Hilton et al., 2013; Bliss, Hilton, Wiley, & Thanos, 2013a; Bliss, Robinson, Hilton, & Wiley, 2013b; Allen & Seaman, 2014).

Setting

The setting for the study was a four-campus community college in the mid-Atlantic region of the United States. In 2017, the student headcount was 23,945, with 64% of the students attending part time. Fifteen percent of the students attended only through the online classes, and an additional 25% of the students were enrolled in at least one online course. The student body is diverse; 45% percent of the students are white, 34% are African American, and 11% are the minorities. Forty-two percent of the students attending the college received Federal Pell Grants (National Center for Educational Statistics, 2017). Federal Pell Grants are needs-based grants, awarded to the students who are unable to afford college fees. The majority of the students who receive Pell Grants use the funds to attend community colleges (U.S. Department of Education, 2017).

The community college was selected for this study because the institution has a robust OER program. The institution is a leader in OER training, policy, and research. It was the first

college nationwide to introduce a textbook-free degree. The institution's OER policy recommends a faculty member participates in a six-module online training program before teaching an OER course. The training program focuses on alignment through course mapping, OER learning materials procurement, Creative Commons licensing, and building a complete learning module. Three of the four instructors in the study participated in the training program. The instructor who did not take the training course was allowed entry because an outside consulting firm trained her during the time the college developed the first textbook free degree.

The majority of OER courses offered at the institution are primarily offered in general education and two program areas, business administration and criminal justice. Per policy and practice, the OER courses have a "Z" in the course section number to indicate to students zero cost for course materials. However, for this study the sections were not marked as Z sections to eliminate self-selection bias by the students and to randomize the students once the registration period was over.

Participants

The study gathered data from two sample groups, community college students and full-time faculty members from the institution. In order to conduct the OER versus non-OER study, the college recruited faculty members who were willing to teach both types of course materials in one semester. Four faculty members volunteered, all female, who typically teach in an online delivery modality. Therefore, the courses were taught online. The faculty members were not paid for participating in the study. Each instructor taught both sections within the discipline and taught the OER course materials using an OER textbook or their own OER course materials. Table 1 illustrates the identifying code for each instructor and the type of OER learning materials used.

Table 1

Disciplines, Instructors, and Types of OER Materials Used

Course Prefix	Course Name	Instructor's Code	Type of OER
CST 110	Introduction to Communication	PA 1	Adopted and adapted OER communication textbook
HIS 111	Western Civilization	PA 2	Created course modules with OER digital content material; self-published some materials
MTH 270	Applied Calculus	PA 3	Created course modules with OER digital content material; self-published some materials
PSY 201	Introduction to Psychology	PA 4	Adopted and adapted OER psychology textbook

Two national publishing firms donated the students the codes for accessing the online textbooks and website for the non-OER sections. The publishers' representatives worked with the faculty members to set up the non-OER courses, before the semester began and offered technology support during the semester.

The student outcome data were obtained from the 2018 spring semester. Data on 215 students was analyzed. Prior to spring registration, an online section of two courses CST 110 and MTH 270 was scheduled to enroll 50 students. In addition, an online section of HIS 111 and PSY 201 was scheduled to enroll 60 students. Once the enrollment reached 50 or 60 students, the

section was closed. Three days before the semester began; the students were randomly divided by the college's enrollment office into an OER or non-OER section.

Measures

The measures used to address the first three research questions were the number of students still enrolled in each section of the OER and non-OER courses at the drop date, the number of students who earned a C or higher for completion and the number of students who finished the course for persistence. Using percentages, the data were compared between the two course sections (OER and non-OER) within each discipline. The fourth research question was measured with numerical data, based on the scores of the final exams. The mean of the exam scores from each OER course section was compared with the mean of the exam scores from each non-OER course section.

The instrument used to address Research Question 5 consisted of questions were developed for the semi-structured interview with the four instructors who taught both the OER and non-OER sections during the same semester. The questions for the interview were developed from a blueprint, using the conceptual framework of COUP. The Open Education community of researchers utilizes this framework to measure the efficacy of OER research in regards to cost, student outcomes, usage of OER, and perceptions of OER (The COUP Framework). Because student cost was neutralized in the study, the researcher did not formulate any interview questions about it. However, because student cost savings was an early focus of the OER research and faculty OER training normally incurs a cost, the framework supports the study. The training and OER procurement costs for faculty is discussed in Chapter 5 under implications for practice. Table 2 illustrates the blueprint, incorporating three of the four elements of COUP, which guided the development of the interview questions.

Table 2

Blueprint for Faculty Interview Questions

	OER Content Material	Publisher Content Material
Experience with use of course content material (Usage)	Q-9; Q-10;	Q-15, Q-16, Q-22
Amount of time spent preparing for the course (Usage)	Q-8	Q-17
Quality of material (Outcome)	Q-12	Q-19
Faculty support services (Outcome)	Q-11	Q-18
Perceived benefit to instructor (Perceptions)	Q-7; Q-14	Q-21; Q-22
Perceived benefit to students (Perceptions)	Q-13	Q-20

Data Collection

The data for the quantitative portion of the study on the student participants were archival and requested from the office of Institutional Effectiveness at the community college. The application for exempt research was approved. No identifiable student data were requested or released. The office of Institutional Effectiveness at the institution exported the data into Excel spreadsheets for data analysis.

The data for the qualitative portion of the study were collected through semi-structured interviews with the instructors. The interview questions were piloted with at least one OER instructor at the college who was not part of the study. As a result, one interview question was modified.

Semi-structured interviews allowed the faculty to share their thoughts, perceptions, and experiences of teaching OER and non-OER course materials. The interviews were scheduled with each faculty member via phone or email. One interview was conducted online through FaceTime, and three interviews were conducted in person. The instructors were given the informed consent form, which they signed, and the interview protocol (Appendix B). The time of the interviews varied from 25 to 60 minutes in length. The interviews were recorded. The first two instructors were first asked about the OER course materials and then about the publisher content materials; the order was reversed for the other two instructors. This provided a counterbalance to the way the questions were asked.

Hayes and Singh (2012) define triangulation "as a common strategy for ensuring trustworthiness involves using multiple forms of evidence as various parts of the qualitative inquiry to support and better describe findings" (p. 207). Triangulation can take the forms of different types of data sources, multiple coders or reviewers, units of analysis, and theoretical perspectives (Hayes & Singh, 2012). Member checking is also a strategy for trustworthiness in qualitative research (Hayes & Singh, 2012). After the interviews, the researcher asked each participant if they would be willing to review the typed transcript of the interview to check for accuracy, clarity, and if the responses correctly reflected their experiences. Interrater reliability refers to crosschecking coding to assure consistency in the findings (Hayes & Singh, 2012). After the researcher completed the coding from the interview transcripts, using direct interpretation, six patterns were established for the results. To check for interrater reliability, an independent researcher was employed and the patterns were confirmed.

Data Analysis

The student data on drops, success, persistence, and exam scores were analyzed using descriptive and inferential statistics. After analyzing the percentages of the students who remained, completed, or persisted in the courses, the data from all the course sections were aggregated and a *z* test of proportions was run to test for significance between the OER sections and the non-OER sections. The analysis of Research Question 4 on common exam scores utilized an independent *t*-test, comparing the mean of the final exam scores in each course section. The results of each analysis are illustrated in Tables 3, 4, 5 and 6 for each quantitative research question in Chapter 4.

Analytic strategies are the researcher's attempt to summarize the collected data through the qualitative process (Kvale, 2008). The researcher used pattern identification analysis to examine the broad categories of the interview responses for their relationships and interaction (Hayes & Singh, 2012). The researcher will utilize the steps described in Hays and Singh (2012) to code the data from the semi-structured interviews. First, codes were developed from the conceptual framework. The COUP Framework is the Open Education Group's approach to studying the effects of open educational resources and open pedagogy in secondary and post-secondary education (Bliss et al., 2013b). After reviewing several times the data from all the four interviews, the researcher clustered the pattern codes to understand the relationships among the participants' responses (Hayes & Singh, 2012). The patterns are presented in Table 8 in Chapter 4.

Protections

The archival student data were not requested and no interviews took place until the exempt research application and dissertation proposal were approved. The student data did not

have any student identification numbers or any identifiable information. A notification and a confidential statement were provided to each faculty member before the interviews. The participants were informed through writing the interviews would be recorded. They were aware they had the right to decline to answer the questions or end the interview at any time. The researcher reiterated she would never share their names during the research and beyond. The participants were also assured the tapes would be destroyed and the transcripts would be secured for five years.

The researcher participated in the Collaborative Institutional Training Initiative (CITI). The researcher took into account beneficence, justice, and respect for person and community. For the study, the researcher honored the responses of the instructors. The risk to the students was minimized because, regardless of whether they were placed in the OER or the non-OER section, they did not have to pay for the course materials. The results of the study will be presented to the open education community to help build the research database on OER.

CHAPTER 4

RESULTS

The mixed-methods sequential study focused on drop, completion, and persistence rates between online courses taught using open educational resource (OER) material and non-OER publisher content. In addition, it also examined the common final exam scores between the OER course sections and the non-OER sections to measure learning. The qualitative phase of the study analyzed the interview responses of the four instructors who taught both the OER and the non-OER courses in their discipline. The chapter describes the results of the data analysis of the five research questions. The first section of the chapter uses descriptive and inferential statistics to report drop, completion, and persistence rates and compare the final exam scores related to Research Questions 1–4. The second section of the chapter addresses Research Question 5 on the instructors' perceptions and experiences of teaching OER and non-OER course materials.

There were 215 students enrolled in online sections of Applied Calculus (MTH 270), Introduction to Communication (CST 110), Western Civilization (HIS 111), and Introduction to Psychology (PSY 201) for the study. The research design allowed the students to be randomly placed in an OER and non-OER section of the course on the first day of class. The course sections were closed to prevent additional students from registering or transferring from one section to another.

Research Question 1: Retention Rates

The first research question explored whether there was a significant difference in retention rate at the tuition drop date for students in OER online courses and students in non-OER courses. The drop date was measured ten days after the course began by the number of the students who remained in the sections. At that point, in the semester, if a student drops the

course, he or she can receive a tuition refund. Table 3 outlines the drop date results by each course discipline and by the aggregated data of all the disciplines.

Table 3

Difference in Drop Rates between OER and Non-OER Sections

Outcomes	OER Section: # of Students Day One	Non-OER Section: # of Students Day One	OER Section: # of Students after Drop Date	Non-OER Section: # of Students after Drop Date	Difference in Retention by Percentage
CST 110	$n = 25$	$n = 25$	$n = 23$ 92%	$n = 20$ 80%	12%
HIS 111	$n = 28$	$n = 27$	$n = 27$ 96%	$n = 20$ 74%	22%
MTH 270	$n = 25$	$n = 25$	$n = 24$ 96%	$n = 20$ 80%	16%
PSY 201	$n = 30$	$n = 30$	$n = 26$ 87%	$n = 24$ 80%	7%
All Disciplines	$N = 108$	$N = 107$	$N = 100$ 93%	$N = 84$ 79%	14%

The results indicated, in the specific courses, the students in the OER sections remained at a higher percentage rate than the students in the non-OER sections at the drop date. When aggregating the data of all the disciplines and conducting a z test of the proportions, a significantly high difference in retention rates at the drop date were found for the students in the OER, compared with the students in the non-OER sections, $z = 3.00$, $p < .05$. Figure 1 illustrates the significant retention rate between the OER and the non-OER courses.

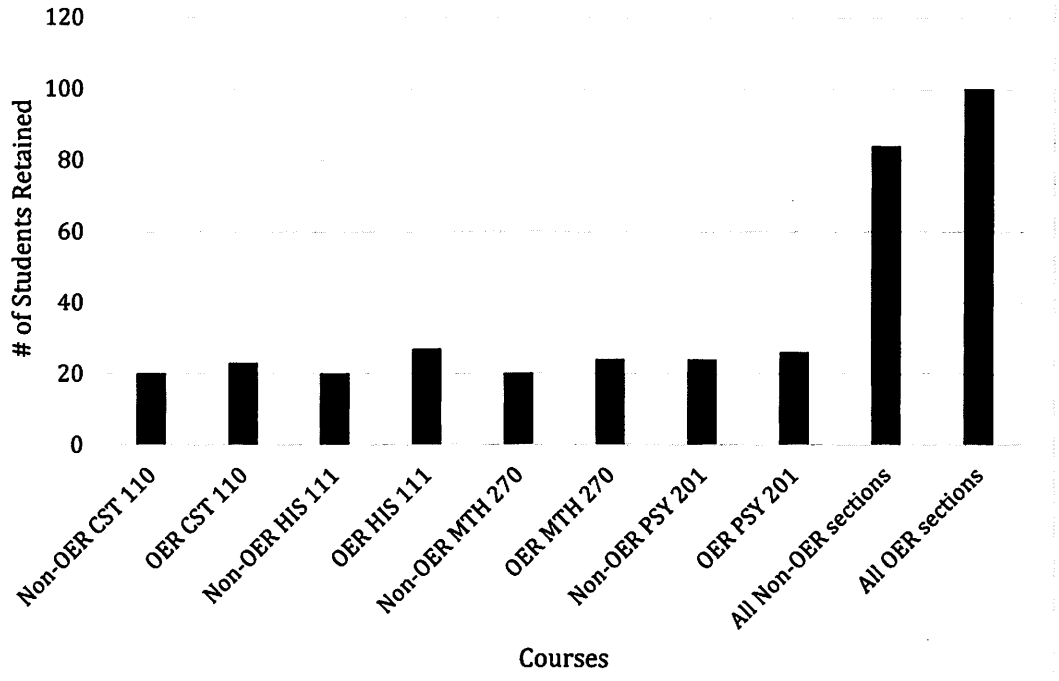

Figure 1. Student retention rate for OER and non-OER courses

From the total sample size, 16 more students retained at the drop date in the OER course sections as compared to the non-OER course sections.

Research Question 2: Success Rates

The second question investigated whether there was a significant difference in the successful course completion rate for students in the OER and non-OER online courses. In OER research, successful course completion is determined by a final Grade C or higher, because it would be considered a transferrable credit (Hilton, Fischer, Wiley, & Williams, 2016; Wiley, Williams, DeMarte, & Hilton, 2016). Table 4 displays the success rate results by each discipline and the aggregated data of all the disciplines.

Table 4

Difference in Success Rates between OER and Non-OER Sections

Outcome	OER Section: # of Students at the Withdrawal Date	Non-OER Section: # of Students at the Withdrawal Date	OER Section: # of Students who Complete with a C or Higher	Non-OER Section: # of Students who Complete with a C or Higher	Difference in Success by Percentage
CST 110	$n = 22$	$n = 18$	$n = 21$ 95%	$n = 11$ 61%	34%
HIS 111	$n = 23$	$n = 15$	$n = 19$ 82%	$n = 12$ 80%	2%
MTH 270	$n = 23$	$n = 17$	$n = 20$ 80%	$n = 16$ 94%	-14%
PSY 201	$n = 20$	$n = 16$	$n = 20$ 77%	$n = 16$ 70%	7%
All Disciplines	$N = 94$	$N = 74$	$N = 80$ 85%	$N = 55$ 74%	11%

To reflect the percentage of the students who successfully completed the courses, the numerical data were compared with the number of the students who left after the withdrawal date rather than the number of students on day one. The results indicated, in the specific course disciplines, the students successfully completed three of the four OER sections at a higher percentage rate than the students in the non-OER. Four more students successfully completed the course in the OER section of MTH 270. However, when comparing by percentage of the students who were left after the withdrawal date, the non-OER section had a higher completion rate by percentage. When aggregating the data of all the disciplines and conducting a z test of the proportions, no significant difference was found in the success rates of students between the OER and non-OER sections, $z = 1.72$, $p = .08$.

Research Question 3: Persistence Rates

The third research question explored whether there is a significant difference in persistence rates for students in the OER courses, compared with the non-OER courses. The number of the students who enrolled in the course and completed the course measured persistence. The measurement included the students who completed the course, with a passing Grade D or higher. Table 5 displays the results of the persistence rates in the OER and non-OER courses by discipline and aggregation of data.

Table 5

Difference in Persistence Rates between OER and Non-OER Sections

Outcome	OER Section: # of Students Day One	Non-OER Section: # of Students Day One	OER Section: # of Students who Finished the Course	Non-OER Section: # of Students who Finished the Course	Difference in Persistence by Percentage
CST 110	$n = 25$	$n = 25$	$n = 22$ 88%	$n = 12$ 48%	40%
HIS 111	$n = 28$	$n = 27$	$n = 22$ 79%	$n = 12$ 44%	35%
MTH 270	$n = 25$	$n = 25$	$n = 22$ 88%	$n = 16$ 64%	24%
PSY 201	$n = 30$	$n = 30$	$n = 22$ 73%	$n = 17$ 57%	16%
All Disciplines	$N = 108$	$N = 107$	$N = 84$ 78%	$N = 57$ 53%	25%

The results indicate, in all the four individual course disciplines, the students in the OER sections persisted at a higher percentage rate than the non-OER sections. Overall, 27 more students persisted in the OER sections. When aggregating the data of all the disciplines and

conducting a z test of proportions, a significant difference was found in the persistence rates of students between the OER and non-OER sections, $z = 3.91, p < .05$. Figure 2 illustrates the significant persistence rate between the OER and non-OER course sections.

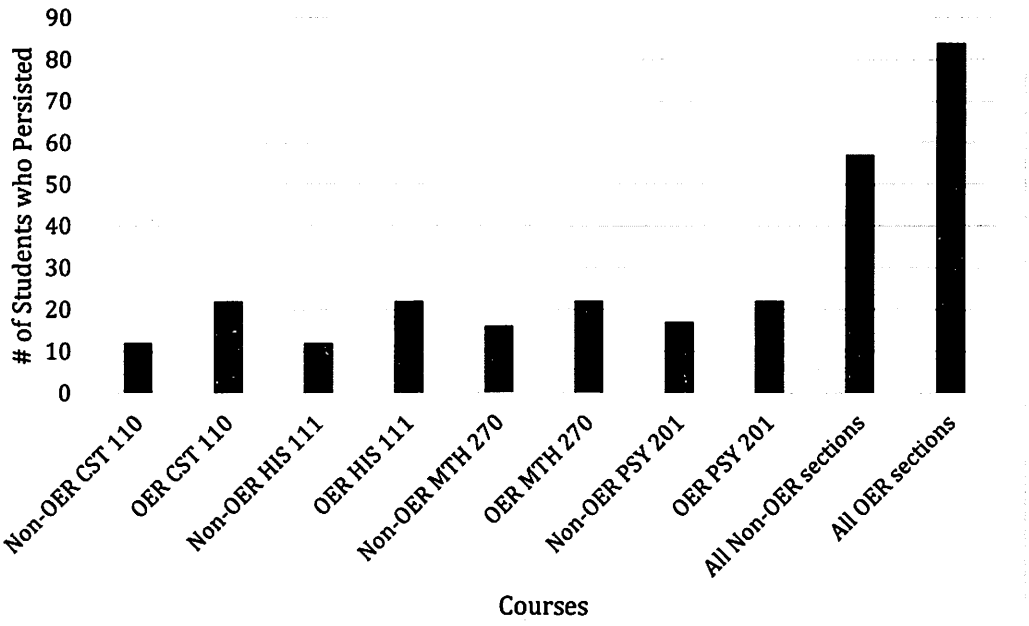

Figure 2. Student persistence rate for OER and non-OER courses

From the total sample size, 27 more students persisted in course sections taught with OER material as compared to course sections taught with publisher content material.

Research Question 4: Final Exam Scores

The last quantitative question probed whether there was a significant difference in the exam scores for students in the OER and non-OER online courses. The instructor in each discipline created a final common exam. The students who remained in both course sections after the withdrawal date were instructed to complete them. The students who did not take the exams were omitted from the statistical analysis. Collectively, 24 students did not take the final exams in the eight course sections. From the non-OER sections, 16 students, and from the OER sections, eight students did not take the exam. However, dependent upon the instructor and the

course, the final exam accounted for different percentages in the final grade. For example, two students in HIS 111, two students in CST 110, and one student in MTH 270 did not take the final exams but were still able to complete the course successfully or persist.

The mean of the exam scores was compared between the OER and non-OER sections within the disciplines. Table 6 displays the results of the mean scores of each course exam by discipline.

Table 6

Mean of Final Exam Scores by Discipline

Course	Non-OER Average Exam Score	OER Average Exam Score	*t* score *p* value
CST 110	$M = 79.44$	$M = 80.26$	$t = .22$ $p = .61$
HIS 111	$M = 74$	$M = 75.71$	$t = .21$ $p = .82$
MTH 270	$M = 84.75$	$M = 77.37$	$t = -1.36$ $p = .86$
PSY 201	$M = 66.22$	$M = 65.72$	$t = -.09$ $p = .26$

The results indicated the students in the OER sections for CST 110 and HIS 111 had a slightly higher mean score on the final exams. In MTH 270 and PSY 201, the students in the non-OER section, on average, scored higher on the final exams than their OER counterparts. When conducting an independent *t* test on the mean of the student exam scores, no significant difference was found for any of the four disciplines.

Research Question 5: Instructors' Perceptions and Experiences

The qualitative question of the study examined the faculty perceptions and experiences of teaching OER course materials and publisher content materials during the same semester. Four full-time faculty members at the community college participated in the study. The interviews were held four months after the end of the semester of teaching both types of course material. Each instructor read the interview protocol and signed the informed consent form.

The researcher piloted the interview questions with a faculty member who did not participate in the study. The faculty member had experience teaching publisher content and OER. Based on the pilot study, a small modification of wording was made to one of the questions that inquired about the number of hours spent on preparing for each online section. The pilot-study participant remarked it was a vague question and was therefore clarified by adding, "in terms of getting the course ready for the students."

After conducting the semi-structured interviews, the audiotapes were transcribed, and the transcripts were sent back to each faculty member to check for accuracy. The researcher used the method of pattern identification for data analysis to examine the responses to the interview questions. Specifically, a three-level analysis was conducted to help draw conclusions about the data: categorical aggregation, direct interpretation, and pattern identification. This is a similar approach to Belikov and Bodily's (2016) qualitative study on faculty perceptions of OER in the community colleges.

Each interview started with the demographic and background questions about the instructor; these were followed by 16 questions about teaching OER and publisher content materials during the same semester (see Table 7). Each instructor was identified by a code: Participant 1 for CST 110 (PA 1), Participant 2 for HIS 111 (PA 2), Participant 3 for MTH 270

(PA 3) and Participant 4 for PSY 201 (PA 4). The codes were used to attribute the verbatim quotations from the interviews.

Table 7

Demographic and Background Information of Instructors

Instructors	PA 1 CST 110	PA 2 HIS 111	PA 3 MTH 270	PA 4 PSY 201
1. Number of years taught at community college	9	4	22	7
2. Number of years teaching online	3	3	15	6
3. Professional development training for online teaching	TOPS Program Quality Matters	Pathways	TOPS Program	TOPS/IDOL Program Quality Matters
4. Professional development training for instructional design	None	Quality Matters	Creating Courses Visual Presentations Adapting Courses for Target Groups	Quality Matters New Horizons
5. Prior semesters taught using OER to Spring 2018	5	6	15	3

All the instructors had experience teaching at a community college, teaching online and teaching OER and publisher content materials. They all had taken some form of professional training development for teaching online. Professional development training for teaching online involves training in the method of delivering online course content. Quality Matters is online

course design training and assessment of how well the course fits the QM rubric ("Why QM?," 2018). TOPS is a program developed by the community college's system office, designed to instruct faculty in the method and practice of delivering online course content ("Teaching Online Program," 2013). The TOPS course has instructional technology and instructional design theory and practice, but it is not the only focus of the program.

The instructors had different answers on how much professional development training they had for instructional design. Professional development training for instructional design involves training on the creation of instructional materials for a specific group. Instructional design combines three discipline fields, psychology, education, and communication to develop the most effective teaching plans for a target audience. One instructor had no experience of instructor design. Two of the four instructors said their instructional design experience was Quality Matters. Only PA 3 had experience of instructional design:

> Instructional design is creating courses as they are related to the stated learning objectives and outcomes. I have received instructional design on adapting the course for particular groups of students, such as the non-traditional working adult.

The results from the exploratory questions in the semi-structured interviews yielded six prominent patterns about the instructors' perceptions and experiences of teaching using publisher content and OER materials. Table 8 displays the identified patterns and a synopsis of the instructors' comments. A paraphrased narrative and participants' verbatim quotations for each pattern follow the table.

Table 8

Patterns Identified Through Qualitative Analysis of Instructors' Interviews

Patterns	Quality of Content Material Publisher vs. OER Content	Alignment and Adaptability of Material with the Course Learning Outcomes	Student Benefits for OER	Teaching Benefits	Perception of Participating in the Study	Experience of Teaching both Types of Material
PA 1 CST	Publisher–adequate OER–high quality	Needed to add material to publisher content for alignment	Student participation higher	Publisher–no benefit OER–flexibility and creativity	Impact on student cost	Frustrated with aligning two types of material
PA 2 HIS	Publisher–adequate OER–adequate	Needed to add material to publisher content for alignment	Retention of students and no cost	Publisher–less work OER – encourages growth	Interested in whatever publishing content available	Frustrated because of student interpretation of publisher content
PA 3 MTH	Publisher–adequate OER–high quality	Needed to delete materials from publisher content for alignment	Building a sense of community through the math discussion forum	Publisher–tech support OER–flexibility	Impact on student learning	Frustrated because of the restrictiveness of publisher platform
PA 4 PSY	Publisher–adequate OER–high quality	No alignment or adaptation of the publisher content needed	Student ease and accessibility of course materials	Publisher–test banks OER–more streamlined	Impact on student cost and the data	Frustrated because of the student difficulty in navigating publisher platform

Pattern 1: quality of content material.

Two patterns emerged about the quality of content material: (a) the publisher content material was adequate, and (b) the OER material was high quality. All the four instructors stated the quality of the publisher content material was adequate for several reasons. The communication instructor (PA 1) thought the quality was adequate, based on the way it was presented: "The quality of the publisher content was good, clear—good content; a unique way of approaching things." The history instructor (PA 2) explained how the publisher textbook approaches a subject from a certain viewpoint:

> The textbook was good, but textbook companies are limited, or publishers are limited to a certain type of approach of history. The old style used to be like they would approach it economically. Today, many textbooks come at an angle where they really highlight the role of women or the role of minority populations in history. This textbook did not write about women in world history and we know they were around. It is really hard to find a good publisher textbook that can encompass it all. Where OER allows you to pull in information.

The math instructor (PA 3) linked the quality of the publisher content to the types of math problems presented and the multimedia used within the platform. While she found the content on the publisher's platform adequate, she also mentioned the weaknesses of the platform:

> I thought it had good quality with regard to the types of math problems that were presented and the multimedia with regard to video. I thought the size of the font was poor, not being able to extrapolate the textbook and video to a different screen or tab was cumbersome. The navigation of the material seemed difficult.

Similar to PA 3, the psychology instructor (PA 4) also commented the quality of the publisher content was good. She stated the publisher's platform had "interesting and novel ways to assess and to engage the students." In addition, she found it easy for the instructor to see how much time the students had spent in the publisher's platform. This feature was also available in the college's learning management system, Blackboard, but the instructor noted it was not as "shiny and engaging."

Three of the four instructors stated the quality of the OER content material was high. PA 1 stated, "The material is very clear, very direct, and very concise. Not a lot of bells and whistles. It is set up in clear modules, so it is easy for the students to navigate." Based on the amount and availability of the OER material, PA 3 said the following:

> Well, obviously I think highly of it. For applied calculus, there was a lot of open education material available. I am able to choose from this section or that section and how it's presented. I can adapt it, and I can interject my materials. I think they are very high quality.

PA 4 referred to the OER training course, recommended by the college, as an example of assessing quality:

> I thought it was fantastic. Like I said, just in my comparison from the other text that I've used. My years here have been my first experience with OER. And the pathways, a course that was available to faculty was very helpful. I love the fact that it's open. There is not a price tag on it, and it is still quality.

The history instructor (PA 2) thought the OER content was adequate but mentioned there were times when the material cannot be located under a creative commons license. Therefore, the instructor remarked she would have to write the material, which was time-consuming.

Pattern 2: alignment and adaptability of material with the course learning outcomes.

The alignment and the adaptation of the course material were two separate interview questions. When answering the two questions, the instructors treated them as one and interwove their answers. The emergent pattern dealt more with alignment and adaptation in the publisher content section rather than the OER section.

Three of the instructors reported the publisher content material was not as aligned or adaptable to the course learning outcomes as the OER material was. PA 1 had to adapt the

publisher material, because the information to support a course-learning outcome was missing; the participant referred to the following course map for the OER section:

> In the publisher's textbook, there was no theory section about interpersonal communication; so I had to create a unit on it. The clunky thing about that though was I was not able to include that in the publisher website, so I had to tell the students go to Blackboard to read about the theories behind interpersonal communication. In the OER section, I did not have to adapt any of the materials because I created the course following the course map.

PA 2 also referred to adding material to the publisher content, because the textbook did not cover topics addressing the course learning outcomes. The instructor also referred to a course map to align the OER section:

> Sometimes you had to assign a small document of small reading on top of the textbook to make sure that you're hitting the most important part. The textbook may not include a topic about, I don't know, the roots of slavery, and how it became race based, which was important. I had to add something on it to make sure you hit the course learning outcomes. I added primary sources to some topic, which weren't included with the textbook package and a couple of readings not in the textbook. The alignment and the adaptability of the OER materials were easy, because I followed the course map.

Due to the community college system's common course learning outcome for MTH 270, the instructor had to adapt the publisher content. PA 4 mentioned using several OER math textbooks to build her course and utilize just the material she needed to support the learning outcomes:

> Yes, I did have to delete; I had to streamline the publisher material to eliminate the extraneous material, because the student was focusing only on the learning outcomes. The way the publisher has their applied calculus designed, they have a lot of material that is not covered for the Virginia Community College System for applied calculus. I deleted a topic that goes into more extensively into partial differential equations or partial derivatives, because the focus is more on the optimization of business and applied problems. In the OER section, I aligned the state learning outcomes with what I had in my syllabus, and then I went through the multiple texts I use, because with OER, I can use just certain sections that I need to align with the outcomes.

The psychology instructor (PA 4) reported the publisher content was aligned with the course learning outcomes, and she did not have to adapt the content material in the non-OER section.

Pattern 3: student benefits for OER.

The emerging pattern for student benefits was the OER course sections offered more advantages than the publisher content sections. Three of the four participants stated the benefits to students using the publisher content material was minimal. They said the students benefited from the publisher material by obtaining a hard copy of the book and through different ways to interact with the materials on the website. The communication studies instructor (PA 1) replied, "I did not observe any student benefits with the publisher content materials."

All the participants expressed positive views about the students' benefits in the OER sections. PA 1 mentioned she had higher levels of student participation in the OER content section than the publisher content section. Although she was not sure as whether this was due to the OER content, she thought, because the course was more "streamlined and targeted," it would be easier for the students to navigate. Two of the four instructors mentioned the cost savings to students when using OER content. PA 2 responded the benefits to the students in the OER section were retention and cost savings and the reading requirement was less, because the course was geared towards the learning outcomes:

> The retaining of students was a lot better, but they did overall better with less extra credit than the textbook section. But I'm more impressed, like the benefit. I just felt like they held on more. Like obviously the cost was for them, and they're all excited, because they don't have to buy a textbook. So, that is a benefit for them. I feel like they enjoy being able to pick and choose topics rather than have this big book, and it is a lot less reading for them. The students tended not to disappear in the OER section.

PA 4 also commented the student benefits with the OER section included cost savings, ease, and accessibility:

> I know students do appreciate the savings. They appreciate the materials can be accessed on any device that has an Internet connection. So, it is not a textbook they have to lug around, or purchase a binder. So, I think it is the ease and accessibility.

The math instructor (PA 3) stated she thought the student participation in the OER section was higher, because the material was more streamlined and easier to follow than the publisher content section. In addition, PA 3 stated the flexibility of the OER platform allowed for a math community forum:

> The most important and effective benefit to the student is the math forum discussion. When a student opens up a problem, and they are working on it, and they don't understand why they keep getting the incorrect answer, they can immediately click on "post to forum." The problem with all of its math formatting is posted immediately, and then they are able to write what they did or did not do, and they have the icon pallet on the forum where they can upload their work as a link. And then other students are able to go in and respond to them. What I have found is that math forum builds a community, and the students are working and helping other students. I monitor the forum daily to make sure the information given out is correct. The publisher content does not have the forum.

The instructors' responses indicated, in their opinion, there appeared to be minimal benefits to the students who were taught using publisher content material. In the OER sections, the instructors indicated the students benefited because of higher participation, cost savings, less reading, community building, ease, and accessibility.

Pattern 4: teaching benefits.

Three of the four instructors stated there were teaching benefits associated with the publisher content material. The benefits included less work, because the material is pre-loaded, supported by technology, has test banks, and is easy for new adjuncts to teach the course. However, for each benefit mentioned, the instructors also stated a disadvantage. The history instructor (PA 2) stated, "I feel like it is a little bit less work, which can be a benefit. But I also feel like you are not challenging yourself as a teacher." The math instructor (PA 3) stated the publisher content offered technical support for both her and the student, but there was no interface to have a math discussion forum in the publisher platform. As mentioned in the

previous section on student benefits, PA 3 thought the math discussion forum was essential to student learning and building a community. PA 4, the psychology instructor, stated the publisher content would benefit a new teacher or an adjunct instructor, because the test banks were ready for the instructor, and the website program graded the assignments automatically. PA 4 also mentioned the publisher website had "a lot of bells and whistles," which some instructors may view as a benefit, but it often made it harder for the students to navigate:

> While the visuals in the publisher's products were eye catching, I felt like there was just too many of them. I received a lot of questions from the students like "Where do I click? Where do I find things?" I did not think the publisher product was as streamlined as the OER course. There was a lot more emails in the beginning of the semester of "Help me navigate this, help me find where I need to go." I never get that with the OER classes that I run through Blackboard.

The communication instructor (PA 1) unequivocally stated, "For me, I do not think there are any benefits teaching using the publisher content material. Everything available in the publisher content is available under a creative commons license."

All the four instructors reported there were benefits to teaching OER content materials. The benefits mentioned were freedom to customize, flexibility, up-to-date content, and the students do not need to sign up for an account. The math instructor (PA 3) elaborated the benefits of teaching using OER:

> There are quite a few. Number one, I have direct control of alignment of material and learning resources to student outcomes. I really broke down the course and was able to see what am I supposed to be teaching these students? What are they expected to know coming out of this course? I really was able to have a fundamental understanding of the objectives of the course by doing that. The second thing is, if something needed to be corrected, I can do it. There is nothing more frustrating than for a student to check an answer in math and there will be a misprint and the answer in the back of the book is wrong. The other thing is cost, I know in this study the cost was neutralized, but saving students money is essential.

Pattern 5: participating in the study.

The emerging pattern was the majority of the instructors participated in the study, because they were interested in its impact on the students. All the instructors stated they

volunteered for the study and three out of the four reported they wanted to participate to see if it benefited the students. PA 1 mentioned the cost savings benefits to the students:

> I firmly believe that OER materials are the way to go in interacting with students. I think the cost of textbooks is outrageous and not worth the benefits. I do not think the bells and whistles do anything for the students. It's certainly not a significant enough difference to make it worth it to charge a student $100 for a textbook.

In addition to cost savings for the students, PA 3 perceived a more global benefit to both herself and the students. Her response incorporated her feelings about teaching using publisher material after working with OER, students' reaction to learning with OER, and the OER benefits to the students who attended college on a military GI bill:

> I like to contribute to the study and research of student learning. The study I think has merit for continuation on a larger number. After teaching with OER, it is difficult going back and using a canned curriculum, even though it is quality with the programmers and all those bells and whistles. If an instructor just wants to go in and monitor a class, that is fine with publisher material, but if an instructor wants to build a community or wants the students to contribute; because I have had students contribute and say, "What can you do to contribute back to the OER community?" I have students who are international students that have said that this would be great taking back to their country or their village. I have military students who really love to have access to the material on the first day; they don't have to worry about the GI bill; they don't have to worry about the whole cost factor. This study really taught me how much my teaching style has changed over the past five years using OER. I mean that it has become outcome based and student focused with interaction.

PA 4, the psychology instructor, stated she participated in the study, because she loved science and enjoyed helping researchers answer their questions. She also stated helping students overcome their challenges was a passion and textbook costs were one of those challenges. Therefore, she was willing to participate to see the outcome of the study and contribute to the field of OER research.

The history instructor (PA 2) stated two reasons for participation in the study. She was interested in the outcomes of the study for student completion. In addition, she was also curious if the publisher content material had changed, because she had been teaching OER materials for

several semesters. As a follow-up question, the researcher asked if the publisher material had changed. The instructor stated it had not, because the materials still seemed to be written from one point of view rather than multiple points of view.

The common theme for Pattern 5 is all four instructors were interested in the impact of the study on the students. While two instructors stressed cost savings to students, the other two took a keen interest in the completion outcomes and thought the OER section made students think more globally.

Pattern 6: teaching both types of material.

All the four instructors expressed a level of frustration when asked what it was like teaching using both types of material in the same semester. The reasons for frustration differed, but it was a common and consistent pattern. For example, PA 1 said she felt frustrated when she tried aligning the terms from the two types of material:

> The biggest frustration was when the content in both the OER and publisher material did not line up the way I thought they should, for example the terms, and having to account for those types of things. I had to use the terms the textbook called for and they were slightly different than the terms of the OER content. For example, power leader vs. emerging leader.

PA 2 voiced frustration because both course sections were aligned, yet the students in the publisher content section focused on names and dates, because it was how the textbook was written. In the OER section, the instructor thought the students concentrated on the concepts of the class. After reflecting for a moment during the interview, the instructor realized the contrast made sense. She built her OER course to emphasize historical concepts, and the publisher built their products on names and dates. PA 2 summed up the experience as "teaching with OER and publisher content material at the same time is teaching two different styles."

PA 3 stated the frustration came from the restrictiveness of the publisher's platform. Because she was not able to show the students directly from the website, it often created additional work for her when a student did not understand a math problem in the publisher section:

> It was very frustrating. The restrictiveness of the publisher content was difficult. When I would get a message from a student with the publisher material, and they would ask if I could show them how to get the correct answer? There was not a math equation pallet in the system, so I would try to use the keyboard, which was very challenging. Often what I would do is just work it out on a piece of paper, scan it, and email it to the student, which I would not have to do in the OER system because it is right there. Because there was no forum in the publisher system; no interaction between the students. I felt like they were more isolated than the OER students were.

PA 4 referred to the students who had trouble navigating the publisher's website as a source of frustration. The instructor also acknowledged that in the OER section the workload is usually at the beginning, because it normally takes time to set up a course:

> It was frustrating at times, because the publisher product was new to me. The students in the publisher content section asked me more questions about navigating the site than the OER section. The OER section I ran it like I always ran it. There is a lot of work on the front end, and then once you get that done and you get the little hiccups worked out, it runs very smoothly. Just because of my unfamiliarity with it I spent more time on the publisher section than I did on the OER section. But it was interesting to teach both at the same time and compare and contrast how much interaction I had with the students in the publisher content section, as I did with students in the OER section.

The common theme for Pattern 6 is all the four participants expressed some type of frustration of teaching both types of material in the same semester, whether it was a form of alignment, the restrictiveness or navigability of the publisher's platform, or the interpretation of the content.

Summary

The purpose of this mixed-methods study was to measure academic outcomes by comparing drop, retention, and completion rates between publisher content online course

sections and OER sections. Additionally, after the semester was over, the instructors were interviewed to gain insights about their perceptions and experiences of teaching both. The following summary discusses the salient points of this chapter.

The results of the quantitative section of the study revealed, at the drop date, more students remained in the OER course sections, compared with the non-OER sections. When aggregating all the student data from all four OER sections and all the four non-OER sections, the difference was significant, indicating higher retention in the OER sections. When comparing completion rates, more students completed with Grade C or higher in three of the four OER sections by percentage than the non-OER section. However, no significance was found. The students in the OER sections across the four disciplines persisted at a higher percentage rate than the non-OER sections. When aggregating all the student data from across the four OER sections and the four non-OER sections, the difference was significant for persistence. No significant difference was found in the mean of the final exam scores between the OER and non-OER course sections.

The qualitative results of the study showed all the four instructors had previous experience teaching OER material prior to the spring of 2018. From the data analysis method of pattern identification, six patterns emerged from the interviews. Pattern 1 indicated all the instructors felt the quality of the publisher content was adequate, but three of them regarded the quality of the OER material high. Pattern 2 revealed more alignment and adaptation was needed in the publisher content sections than the OER sections. Pattern 3 showed, according to the instructors, the OER courses provided more student benefits than the non-OER courses. Pattern 4 revealed the instructors felt there were more benefits to teaching an OER section than non-OER. Pattern 5 suggested all the instructors participated in the study, because they were interested in

its impact on the students. Teaching both OER and publisher content materials in the same semester was frustrating for the instructors, which was Pattern 6. These qualitative and quantitative results, along with the implications and limitations of the study, will be discussed in Chapter 5.

CHAPTER 5

DISCUSSION

The purpose of this sequential mixed method study was to understand whether the use of OER course materials improves student drop, completion, and persistence rates, compared with the same course taught using non-OER course materials when eliminating cost and accounting for instructor bias. Additionally, the study also sought to gain insights into the perceptions and the experiences of the instructors who teach an OER and a non-OER course within the same semester.

Student Retention

Student retention was measured by comparing the number of the students who started in the course section with the number of the students who remained after the tuition drop date, which is 10 days after the 16-week semester begins. The results showed at the drop date in the OER sections, 100 students remained, and in the non-OER sections, 84 students remained, illustrating a significant difference of 14% in retention rate. The results are similar to what Wiley, Williams, DeMarte, and Hilton (2016) found in a two-semester study compared the OER courses to the non-OER ones. Subsequently, drop rates were tested again over four semesters, comparing OER courses to their non-OER counterparts, and a significant difference was found in the drop rate favoring the OER courses (Hilton, Fischer, Wiley, & Williams, 2016).

However, in neither of the previous studies were the students randomized. The students in the OER courses were self-selected, because the sections were designated with a "Z" to indicate textbook-free. In this study, students were randomized into OER and non-OER course sections. OER researchers have hypothesized students in the OER courses have a lower drop rate, because they have early access to the course materials and do not have to buy textbooks.

The students often reported they had postponed purchasing textbook, because they needed to save money for them (Florida Virtual Campus, 2016). This was not the case in this study, because costs were neutralized between the OER and non-OER course sections. There may be other contributing factors, leading students to remain in an OER section versus a non-OER section, such as course design or ease of use of the course materials.

Student Completion

Student completion was measured by how many students successfully passed the course with a final Grade C or higher. When aggregating the completion data across the four disciplines after the withdrawal date, 80 students successfully completed the OER sections, and 55 students successfully completed the non-OER sections. The difference favored the OER sections by 11%, but it was not significant.

These results are consistent with what Hilton, Gaudet, Clark, Robinson, and Wiley (2013) found in their study on OER math courses at a community college, where no significant difference in successful completion in the OER math courses was reported. More recently, Winitzky-Stephens and Pickavance (2017) found OER was not a significant factor for sustaining student success in 14 general education courses. Their study found course and student levels variables were more predictive than the OER. However, their study did find OER has a small positive effect on new students and their course grade, indicating OER may be of importance to first-time college students who are not used to buying textbooks. The researchers in both studies concluded implementing OER in the classroom does not seem to harm students and has no negative effect on their final grade or their ability to pass (Hilton et al., 2013; Winitzky-Stephens & Pickavance, 2017).

Several previous OER studies reported significant differences in completion between OER and non-OER courses. Feldstein, Martin, Hudson, Warren, Hilton, and Wiley (2012) found significant lower failure rates in the OER business course, using an open textbook when compared with courses taught using publisher content material. Similar significant results favoring OER were found for students when Hilton et al. (2016) analyzed the completion rates between OER courses and non-OER courses over a five-semester period. In Chiorescu's (2017) study of an open textbook for college algebra, the students had significant higher completion rates in the OER section than the non-OER one. In addition, Argon and Johnson's (2008) study found students who completed in online classes tended to enroll in more online classes. All these studies indicate there may be an interaction between OER course materials and completion.

A concern with the OER efficacy lies in the inconsistency of the findings concerning successful completion. The inconsistency in the results could be from the research design, instructional design of the course, the type of OER material used, the length of the study, sample size, or a number of other unaccounted for factors. However, in this study, when comparing the OER sections to the non-OER sections by percentage, more students successfully completed the OER sections.

Student Persistence

Persistence was measured as the percentage of the students who finished a course, compared with the students who enrolled in the OER or non-OER courses. The measurement is based on the Successful Course Completion Ration (SCCR) for persistence (Hagedorn, 2006). Overall, the significant difference in the persistence rate was 25%, favoring the OER sections.

To date, the researcher had managed to find only one OER study supports the findings of this study for persistence. Grewe and Davis (2017) found the use of OER course materials was a

significant predictor of student achievement in online history courses. The researchers assigned numbers to the letter grade variables in the regression model to account for student achievement. Therefore, the study measured persistence, because the students who earned Grade D were accounted for.

More important, several studies have cited financial reasons as a factor prevents community college students from persisting. Nakajma, Dembo, and Mossler (2012) found the largest predictor of persistence was the student's overall GPA; however, the researchers also discovered significant results for the financial variables and their impact on student persistence. The total number of work hours for students was negatively correlated with persistence (Nakajma et al., 2012). The students in a community college STEM program mentioned financial reasons for not persisting in the program (Chang & Wang, 2017). Wood and Harris (2015) established low living expenses were a significant predictor for Black and Latino males in community colleges. From previous OER studies, it can be understood students save money when taking OER classes (Hilton, Gaudet, Clark, Robinson, & Wiley, 2013; Hilton, Wiley, Robinson, & Ackerman, 2014; Chiorescu, 2017). Based on the persistence and financial factor studies, it may be possible to offer OER courses to increase persistence for community college students.

Student Exam Scores

The results of comparing the mean of the final exam scores showed the students in the OER sections of CST 110 and HIS 111 had a slightly higher mean score between .82–1.71, albeit not significant. The students in the non-OER sections of MTH 270 had a higher mean score of 7.38 points. The difference was not significant. In the PSY 201 non-OER section, the exam mean scores were slightly higher .5, albeit not significant.

The findings are consistent with previous OER studies, examining final exam scores between OER and non-OER course sections. Lovett, Meyer, and Thille (2008) found no significant difference in exam scores, when comparing course materials in a statistics course. No significant difference was found in the exam scores for the OER chemistry course versus non-OER (Allen, Guzman-Alvarez, Smith, Gamage, Molinaro, & Larsen, 2015). One study showed higher exam scores for an OER psychology course over the traditional textbook, but the researchers did not test for significance (Hilton & Laman, 2012).

The objective of the research question about whether there was a significant difference in the final exam scores between the OER and non-OER online sections was to measure learning. Collectively, 24 students did not take the exam in the eight course sections. However, five students who did not take the final exam were able to pass the courses successfully. Therefore, the researcher believes this was a flawed research question. One final exam cannot be a true measure of learning, when there are multiple assignments and assessments in the course. Learning occurs throughout the semester, based on the numerous factors at the course and student levels.

Instructors' Perceptions and Experiences

Based on the instructors' responses to the interview questions, six patterns emerged: quality of content material, alignment and adaptability of material with the course learning outcomes, student benefits for OER, teaching benefits, perceptions of participation in the study, and experience of teaching both types of material.

Pattern 1: quality of content material.

All of the instructors thought the quality of the publisher content material was adequate for different reasons. The researcher was not able to find a peer-reviewed study on community college faculty members' perceptions of publisher content material; therefore, it is difficult to comment on the extent of the consistency of the findings.

Three of the four instructors thought the OER material was of high quality, because of its clarity, ease of navigability, no price tag for students, and the adaptability of the content. These findings are consistent with the previous literature. Bliss, Robinson, Hilton, and Wiley (2013b) analyzed 58 faculty members' perceptions of OER and found 55% of the instructors thought the quality was as high as publisher content and 35% thought they were better. Allen and Seaman (2014) surveyed 2144 college professors about the quality of OER materials and 61% reported the open materials were of the same quality as the publisher content material and 21% thought the OER materials were superior.

The history instructor (PA 2) thought the OER content was adequate, but there were times when the material could not be found under a creative commons license. Therefore, she would need to write the material herself, which was time-consuming. Creating additional resources and time constraints have been introduced as barriers to OER in a previous study of K–12 teachers (Kimmons, 2016).

Pattern 2: alignment and adaptability of material with the course learning outcomes.

Three of the four instructors said there was more alignment and adaptation of the publisher content material section than the OER section. Without previous research on publisher content material, it is difficult to determine whether the findings are consistent or not.

The way the three instructors designed their OER courses could account for this pattern. All the three instructors designed their OER course by building modules from OER textbooks, learning materials, and videos available on the Internet. When designing their courses, they started with the course learning outcomes and found course material, assignments, and assessments to support them. The method is known as course mapping, equivalent to the backwards design process (McTighe & Wiggins, 2012). Therefore, when they taught the OER course, they knew it was aligned to the course outcomes. Because they did not build the publisher content material, the instructors had to make adjustments.

Pattern 3: student benefits from OER.

The four instructors reported the students received more benefits from the OER course sections, because the costs were low, the learning material was streamlined and targeted, and the students were more engaged in the course because of the discussion forums. From previous research, it is apparent faculty care about saving students money. The instructors reported they adopted open textbooks or built OER courses primarily because they were concerned about textbook costs for students (Hilton et al., 2013; Hilton et al., 2014; Chiorescu, 2017).

Three of the four instructors mentioned, when they taught using a traditional textbook, they felt guilty because they did not use all the chapters of the book; however, with the OER course, they can streamline the material to the learning outcomes, and there is less reading for the students to complete. This finding is consistent with a study of nursing instructors who found OER a stimulating and effective way of acquiring knowledge, which supported flexibility and self-directed studies (Elf, Ossiannilsson, Neljesjo, and Jansson, 2015).

The math instructor found teaching in the OER math platform allowed for the students to participate in a math discussion forum, which gave students the opportunity to post questions

and/or an example of a problem they had trouble answering. The other students could answer them back through the forum. The instructor reported this created a sense of community for the class. A similar finding was reported in Cronin's (2017) study of open educational practices, where the faculty felt the students who were taught using OER would benefit from social learning.

Pattern 4: teaching benefits.

All the participants in the study stated teaching with OER had many benefits. Two frequent responses indicated OER allowed the faculty member the freedom to customize the materials and the flexibility to modify them to keep them up to date. In Bliss et al.'s (2013b) study, the faculty reported one of the benefits of OER was flexibility.

The faculty reported the students enjoyed the ease of signing into a system to get their learning materials, and they did not have to sign up for an additional account. The OER learning materials can reside in an institution learning management system. Three of the four instructors reported, at the beginning of the semester, some students had trouble signing into the publisher's website and often had trouble navigating it. One instructor noted the bells and whistles for the publishers' websites are attractive, but they often led the students to feel overwhelmed and confused. The psychology instructor thought the publishers had created the website content having in mind the four-year students, because this way they had time to sit in a library and click on different items. However, the community college students need the information "lean and clean," because they have so many other competing commitments.

Three of the four instructors stated the publisher content material had many teaching benefits, which involved less work, mainly because the test banks were provided and the instructor was supported by technology. One instructor also mentioned ready test banks and

course set-up in the publisher's website would benefit adjunct instructors who were hired at the last minute. In the fall 2017, at the college where this study occurred, 74% of instructors were adjunct faculty and 26% were full-time faculty (National Center for Educational Statistics, 2017). Considering the large amount of adjunct faculty having a course set-up and ready to go would be an advantage.

Pattern 5: participating in the study.

The four instructors volunteered to participate in the study, because they were interested in the academic impact of this study on students. Two participants stated they liked the fact the OER materials save students money, because they do not have to purchase expensive textbooks. This is consistent with the early findings (Hilton et al., 2013; Hilton et al., 2014; Chiorescu, 2017).

The math instructor (PA 3) stated higher levels of engagement occurred in the OER section, because the students felt they belonged to a special math group and shared a common understanding about its openness and ability to share and collaborate about knowledge. The math discussion forum was a significant part of this. According to Clark (2012), engaging community college students and making them feel they a part of something great is key to persistence.

When the researcher reported to the instructors the results of the quantitative portion of the study, they were hardly surprised. All of the instructors stated they had seen the students who had stopped participating in the non-OER online sections throughout the semester, despite their best efforts to encourage them to continue. They reiterated they felt more students in the OER sections remained and persisted, because the course design was easier to access and navigate, the material was more targeted, and students were more engaged. Two studies on students'

perceptions of OER course materials confirm the instructors' feelings. The majority of the students in Feldstein et al.'s (2012) study who used OER material in their business courses reported OER was easy to use and provided more up-to-date, relevant materials than textbooks. Petrides, Jimes, Middleton-Detzner, Walling, and Weiss' (2011) study on OER versus non-OER in a statistics course reported the students preferred using open textbooks, mainly because they were easier to use.

Pattern 6: teaching both types of material.

The instructors reported a similar feeling of frustration with teaching both types of material at the same time. However, the frustration stemmed from different issues. The communication instructor was frustrated, because she tried providing the same learning experience for both sections of the course; however, aligning the material was difficult, because of the different terms and definitions. The history instructor felt frustrated, because the publisher's course material emanated from different viewpoints. The math instructor's frustration originated in the restrictiveness of the publisher platform and the fact she was not able to work within it and create a math community with a discussion forum. She found herself allocating more time to answering the students' questions in the publisher's platform. Time was also a factor for the psychology professor, because she found setting up the publisher's website difficult as it was new to her. Her students also found the publisher's website was difficult to navigate at the beginning and she reported spending considerable time helping them.

This pattern of frustration among the faculty members can be a contributory factor to high drop rates and low persistence rates in the non-OER sections across all the four disciplines. The trouble of signing into the publisher's website and navigating the website was considered a

barrier for some students. This barrier may have led some students to drop and not persist, despite getting the publisher content material free.

Limitations

This study has several limitations affecting the internal and external validity. The archival student data were obtained from one community college, precluding the extrapolation of the results to other institutions. The missing data were exam scores for 22 students who did not complete the final exam. These students were not included in the statistical analysis of the final exam scores between the OER and non-OER course sections. The student data were collected from courses taught online, which tend to have high drop, withdrawal, and failure rates for community college students (Xu & Jaggars, 2011).

The study was limited to four faculty members. The interviews with the four faculty members contained self-reports from one community college. An additional limitation may relate to the recording of the participants' comments, in that they may not have been fully open and honest about their perceptions and experience (Seidman, 2012).

Volunteer bias is another limitation of the study. The instructors all had previous experience teaching open educational resources, ranging from three semesters to fifteen semesters. While the researcher believes they tried to provide a balanced view of both the OER and non-OER sections in terms of course material and learning experiences, it was clear from the interview responses they preferred teaching using OER. One of the four instructors (i.e., PA 3) was an innovator, when the institution first began the OER project. The other three instructors (PA 1, 2, & 4) were early adopters.

To account for some of these limitations, the researcher developed the interview questions from a blueprint to reflect the framework of the study. Piloting the interview questions

with a non-participant instructor resulted in a modification of one question. However, the question modified did not produce any emerging pattern.

Interrater reliability and member checking lent credibility to the qualitative findings. A check for interrater reliability was conducted with another researcher, once the data were coded and the patterns were confirmed. The researcher asked the instructors to read the interviews once they were transcribed. The instructors did not report any irregularities. Verbatim quotations were provided in the results section to support the emerging patterns. The researcher knows the instructors, has experience working with OER content materials, and made every effort to remain objective.

Implications for Research

Hilton (2016) conducted a literature review of the studies pertaining to OER efficacy and faculty and student perceptions of OER. In the discussion section of the review, Hilton (2016) states the current issues with OER research are design differences in the types of the OER material used (open textbooks or digital content), frequent change in delivery modality, stronger research design by randomizing students, and attempts to control for student and teacher differences. Specifically, Hilton (2016) states, "Ideally future research could be structured in such a way that students are randomly assigned to open and traditional textbooks, an option that admittedly would be difficult to pursue" (p. 587).

The design of the quantitative portion of this study is what Hilton (2016) states would be ideal for future research, except for two cases. While the instructors had the freedom to choose the type of OER material they wanted to use, two used OER textbooks and another two used OER digital content. Second, the study did not account for student differences. However, the study randomized the students and used one mode of online delivery modality, the courses were

taught in the same 16-week semester length, and the same instructor taught the non-OER and OER sections within the course discipline. Additionally, this study is unique, because the publisher access codes to the course material were donated, negating all textbook costs for the students; the study provided insights into the perceptions and experiences of the instructors who teach both types of material in the same semester. Neither of these factors were previously studied.

The quantitative results of the study contribute to the field of knowledge on OER efficacy. The results indicated compared with non-OER courses, OER course materials have significantly low drop rates at the tuition reimbursement date and significantly high persistence rates. By percentage, the students in the OER sections outperformed the non-OER sections in retention, completion, and persistence. The mean differences of the final exam scores between the non-OER and OER sections were not significant. As noted earlier, this was a flawed research question, because, through additional research and discovery, more factors tend to determine learning than one single final exam.

The qualitative results of the study contribute to the field of knowledge of faculty perceptions and experiences of OER. The instructors who taught both types of material during the same semester rated the quality of the OER materials higher than the publisher content. They found the publisher content more difficult to adapt and align to the course learning outcomes. This finding could be due to the fact the instructors all had previous experience teaching with OER materials and participated in course mapping. Course mapping at the institution where the study was held consisted of aligning each learning outcome to the reading material, videos, practice exercises, and then aligning the assignment to support the course materials, and aligning the assessment to the assignment. Two faculty members enthusiastically stated when they were

building their OER courses the mapping and alignment made them assess assignments they had used for years, which caused them to eliminate some and revise others. This led to a feeling of a renewed and regenerated courses. The faculty members reported teaching using OER was flexible and engaging and had an important impact on student motivation. All the instructors agreed teaching both types of material during the same semester was frustrating, due to issues with the publisher content material and the website, including a lack of adaptability, a lack of multiple viewpoints, a lack of a community discussion forum, and a lack of understanding on the students' part about the way to navigate the site.

The instructors reported student learning occurs through a series of assignments and one assessment such as a final exam does not accurately assess how much learning took place. Results of multiple assignments throughout the course of a semester are a stronger indicator of student learning if those assignments are designed for students to explain or demonstrate. All four instructors had at least eight assignments in both courses requiring students to write an explanation or solve a math problem.

Based on the results of this study, future research should focus on repeating this study with a larger sample size of students to analyze retention, completion, and persistence rates in OER and non-OER studies with course materials cost neutralized. A larger pool of faculty members would add additional insights into teaching both types of material at the same time. This study is a baseline for this type of research. Some researchers may be concerned it would be difficult to get the publishers to donate codes to their textbook digital platforms they normally sell. However, it would make business sense for the publishers to be just as interested in the academic outcomes and the faculty experience as the OER proponents are.

A significant focus today is on math completion in community colleges. Successfully passing a math course is removing a barrier for a student to finish a certificate or degree. The results of this study showed students who were in the MTH 270 OER section persisted at a higher percentage rate than students in the non-OER section. While this study did not account for student demographics, it does indicate some type of barrier was removed for students in the OER section. Therefore, this study falls into the "do no harm" category established by researchers in the OER field (Hilton, Gaudet, Robinson, Jared & Hilton, 2013). This category of research establishes while researchers may not know what factor caused the students to persist at a higher rate in an OER section; the researchers do know the OER course material or design did not harm the students' ability to persist.

Additional future research should also include a statistical analysis controlling for student factors (age, GPA, gender, Pell eligible) and then determine if there is an interaction with OER in relation to retention, completion, and persistence. Grewe and Davis (2017) controlled for student achievement, while equalizing the mode of delivery, length of class, and instructional design of the courses. They found a positive relationship between OER and persistence. However, they did not equalize course material costs or have the same instructor teach both the OER and non-OER course sections.

One limitation of the study was the faculty sample size was small. If duplicating the study researchers could offer some type of incentive to faculty to increase participation. An incentive could also compensate faculty members for the time it takes to build an OER course or adapt a course. All four instructors in the study reported they felt rushed as the beginning of the semester preparing for the OER section and the non-OER section at the same time. An optional method would be to conduct the study sequentially with the OER course in the fall and the non-

OER course in the spring. The same controls could be utilized, the same instructor, the same semester length and the same mode of delivery, but within two semesters rather than one. This type of sequencing could reduce the amount of stress and frustration the faculty members reported working with two types of course materials at once.

Previous OER research has established the main advantage of OER lies in the cost savings for students (Hilton et al., 2013; Hilton et al., 2014; Chiorescu, 2017). This study eliminated the costs for OER and non-OER. The results favored the OER sections. The OER researchers who focus on the OER cost savings for students may have a narrow focus. Perhaps the benefit lies in the instructional design and ease of navigability of the OER course, leading to significant low drop rates and significant high persistence rates. Further research is needed to build on this study and the study of Grewe and Davis (2017) to determine which OER components (material and/or design) may affect student academic outcomes.

Implications for Practice

Even though the focus of this study was not financial, the college retained an additional $9,152 in tuition revenue from the students in the OER sections at the drop date. The tuition dollars retained supports a hypothesis proposed by Wiley et al., (2016) that due to lower drop rates courses taught with OER materials create a source of revenue for the institution. Two studies found students retain at a significant higher rate in courses taught with OER materials (Wiley et al., 2016; Hilton et al., 2016). The results of another study indicated students persist at significant rate in courses taught with OER materials (Grewe & Davis, 2017). An institution may wish to conduct a cost-benefit analysis to determine the rate of return on the retained tuition dollars. A portion of this money could fund an OER coordinator and a tech support program to sustain an OER program.

Student enrollment in community colleges has decreased since 2012 (National Center for Educational Statistics, 2012–2017). The financial focus of community colleges has changed from enrollment to retention, completion, and persistence (Phelan, 2016). More than 32 states have now some type of performance-based funding, tied to student outcomes. Community college practitioners now have to figure out how to get more students enrolled, keep them there, and have them leave with some type of certificate or degree.

Statistics of the Community College Research Center (CCRC) at Columbia University (2016–2017) illustrates 62% of the students returned to college the following fall, with 49% returning to their original institutions. A study conducted by the CCRC in a community college system found, of all the courses taken by the students, the online completion rate was 12.7 percentage points lower than the face-to-face completion rate (Jaggars & Xu, 2010). The authors defined completion as the number of the students who achieved a D or a higher grade. This study found the persistence rate of the students (the students who finished the course with a D or a higher grade) in the online OER sections was 25% higher than the non-OER sections. While this is not to suggest a one-to-one comparison of course types, the results of this study entail some implications.

Offering OER courses can be an innovative solution to student completion and persistence issues in online courses. Odessa Community College significantly improved their retention and graduation rates by 11% over three years by implementing several initiatives around student engagement and shortening the length of their classes from sixteen weeks to eight weeks (Leah Meyer Austin Award, 2018). Additionally, the college just started transitioning general education courses to OER materials to measure the impact on retention and graduation

rates (Musil, 2018). Teaching courses using OER alone may not be the answer; however, it may be useful to integrate the practice with other initiatives.

Furthermore, from previous studies on faculty members' awareness and perceptions of OER course materials, the majority of the faculty rate OER materials equal or superior to publisher content material (Bliss, Robinson, Hilton, & Wiley, 2013; Allen & Seaman, 2014). The instructors' interviews in this study revealed similar results. The majority of the responses favored OER. Considering the growing positive attitudes about OER creation and/or adaptation, perhaps more faculty will start utilizing OER materials in the future.

However, the creation and use of OER courses are not without a cost, for which the community college leaders should plan. There are no content licensing costs for offering OER courses, although there is a cost to the faculty member or the institution. The cost of OER involves the amount of time devoted to locating the material, reviewing the material, managing open licensing attribution, integrating OER with an institution's learning management system, and integrating OER with teaching and learning practices (Wiley et al., 2016). Creating and sustaining an OER movement requires additional personnel.

Some universities have adopted creative solutions to finding additional personnel by engaging the institution's librarians and having them lead the OER endeavor. Librarians have expertise and training in copyright licensing as well as teaching and faculty professional development. For example, Virginia Tech has created a library-leading program called *Open Education Week* to motivate the faculty to learn about OER. In addition, Virginia Tech supports an Open Education and Copyright and Scholarly Communication librarian (Salem, 2017). Additional library-led OER programs are also active in colleges and universities in

Massachusetts, Minnesota, and Ohio (Salem, 2017). With a support system in place, an effective OER program can be built and sustained.

Conclusion

The purpose of this sequential study was two-fold. First, to compare the academic outcomes of the students who randomly enrolled in online non-OER sections with the students who enrolled in online OER sections in four disciplines. In addition, this research intended to gain insights about and knowledge of the four instructors' perceptions and experiences of teaching both types of material during the same semester. The results indicated a significant difference, favoring the students in the OER sections for retention and persistence. The qualitative results, based on the instructors' interview responses, also favored OER for quality, adaptability, and student and teaching benefits. The design of the study accounted for teacher effect and equalized the cost between the OER and non-OER courses.

The findings point to a potential solution to improving student retention and persistence in online courses at community colleges. The faculty members' responses suggest they enjoy OER materials and prefer using them. As a community college practitioner, this researcher cautions an OER program for material creation and/or adoption should be part of a broader student success initiative. As with any student success initiative, faculty, librarians, and administrators should support it. It should not be considered the only solution to increasing retention and graduation rates in community colleges. Further studies are recommended for effective OER in relation to access, course design, and student demographics. The results of this study are promising and add useful insights to the literature.

REFERENCES

Allen, E., & Seaman, J. (2014). *Opening the curriculum: Open educational resources in U.S.* Retrieved from https://files.eric.ed.gov/fulltext/ED572730.pdf

Allen, G., Guzman-Alvarez, A., Molinaro, M., & Larsen, D. (2015). Assessing the impact and efficacy of the open-access ChemWiki textbook project. *Educause Learning Initiative Brief.* January 2015. Retrieved from https://net.educause.edu/ir/library/pdf/elib1501.pdf

Aragon, S. R., & Johnson, E. S. (2008). Factors influencing completion and noncompletion of community college online courses. *American Journal of Distance Education, 22*(3), 146–158.

Atkins, D. E., Brown, J. S., & Hammond, A. L. (2007). A review of the open educational resources (OER) movement: Achievements, challenges and new opportunities. *The William and Flora Hewlett Foundation.* Retrieved from https://www.hewlett.org/wp-content/uploads/2016/08/ReviewoftheOERMovement.pdf

Bailey, T., Jenkins, D., & Leinbach, T. (2005). What we know about community college low-income and minority student outcomes: Descriptive statistics from national surveys. *Community College Research Center.* Retrieved from http://ccrc.tc.columbia.edu/publications/low-income-minority-student-outcomes.html

Belikov, O. M., & Bodily, R. (2016). Incentives and barriers to OER adoption: A qualitative analysis of faculty perceptions. *Open Praxis, 8*(3), 235–246.

Bissell, A. (2009). Permission granted: Open licensing for educational resources. *The Journal of Open, Distance and e-Learning, 24*(1), 97–106.

Bliss, T., Hilton, J., Wiley, D., & Thanos, K. (2013a). The cost and quality of open textbooks: Perceptions of community college faculty and students. *First Monday, 18*, 1.

Bliss, T. J., Robinson, T. J., Hilton, J., & Wiley, D. A. (2013b). An OER COUP: College teacher and student perceptions of open educational resources. *Journal of Interactive Media in Education,* (1). Retrieved from https://jime.open.ac.uk/articles/10.5334/2013-04/

Bol, L., & Garner, J. K. (2011). The challenges of e-learning initiatives in supporting students with self-regulated learning and executive function difficulties. *International Congress for School Effectiveness and Improvement.* Retrieved from http://www.icsei.net/icsei2011/Full%20Papers/0108_C.pdf

Bowen, W. G., Chingos, M. M., Lack, K. A., & Nygren, T. I. (2012). *Interactive learning online at public universities: Evidence from randomized trials*. Ithaka S + R. Retrieved from http://mitcet.mit.edu/wp-content/uploads/2012/05/BowenReport-2012.pdf

Caswell, T., Henson, S., Jensen, M., & Wiley, D. (2008). Open educational resources: Enabling universal education. *The International Review of Research in Open and Distributed Learning, 9*(1). Retrieved from http://www.irroldl.org/index.php/irrodl/article/view/469/1001

Chan, H. Y. & Wang, X. (2017). Momentum through course completion patterns among 2-year college students beginning in STEM: Variations and contributing factors. *Research in Higher Education, 59*(6), 704–743.

Chiorescu, M. (2017). Exploring open educational resources for college algebra. *International Review of Research in Open and Distributed Learning, 18*(4). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/3003/4223

Clark, L. (2012). When nontraditional is traditional: A faculty dialogue with graduating community college students about persistence. *Community College Journal of Research and Practice, 36*(7), 511–519. doi:10.1080/10668926.2012.664090

Community College FAQs (2018). CCRC: Community college research center. *Teachers College Columbia University.* Retrieved from https://ccrc.tc.columbia.edu/Community-College-FAQs.html

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches.* Thousand Oaks, CA: Sage.

Cronin, C. (2017). Openness and praxis: Exploring the use of open educational practices in higher education. *The International Review of Research in Open and Distributed Learning, 18*(5), 1–13.

Elf, M., Ossiannilsson, E. Neljesjo, M., & Jansson, M. (2015). Implementation of open educational resources in a nursing programme: Experiences and reflections. *Open Learning, 30*(3), 252–266.

Federal Textbook Price Disclosure Law. (2012). *Student PIRGs*. Retrieved from http://www.studentpirgs.org/resources/textbook-price-disclosure-law

Feldstein, A., Martin, M., Hudson, A., Warren, K., Hilton, J., & Wiley, D. (2012). Open textbooks and increased student access and outcomes. *European Journal of Open, Distance and E-Learning*. Retrieved from http://www.eurodl.org/materials/contrib/2012/Feldsteint_et_al.pdf

Fischer, L., Hilton, J, Robinson, T. J., & Wiley, D. A. (2015). A multi-institutional study of the impact of open textbook adoption on the learning outcomes of post-secondary students. *Journal of Computing in Higher Education, 27*(3), 159–172.

Florida Virtual Campus (2016). 2016 Student textbook and course materials survey: Results and findings. *Florida Virtual Campus: Office of Distance Learning & Student Services.* Retrieved from http://www.openaccesstextbooks.org/pdf/2016_Florida_Student_Textbook_Survey.pdf

Grewe, K. E., & Davis, P. W. (2017). The impact of enrollment in an OER course on student learning outcomes. *The International Review of Research in Open and Distributed Learning, 18*(4). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/2986/4211

Hagedorn, L. S. (2006). How to define retention: A new look at an old problem. *Transfer and Retention of Urban Community College Student Project,* 1–26. Retrieved from http://files.eric.ed.gov/fulltext/ED493674.pdf

Hayes, D. G., & Singh, A. A. (2012). *Qualitative inquiry in clinical and educational settings.* New York, NY: The Guilford Press.

Hilton, J. (2106). Open educational resources and college textbook choices: A review of research on efficacy and perceptions. *Education Technology Research Development, 64*, 573–590. doi:10.1007/s11423-016-9434-9

Hilton, J., Fischer, L., Wiley, D., & Williams, L. (2016). Maintaining momentum toward graduation: OER and the course throughput rate. *International Review of Research in Open and Distributed Learning, 17*(6), 19–27.

Hilton, J., Gaudet, D., Clark, P., Robinson, J., & Wiley, D. (2013). The adoption of open educational resources by one community college math department. *The International Review of Research in Open and Distance Learning, 14*(4), 37–50.

Hilton, J., & Laman, C. (2012). One college's use of an open psychology textbook. *Open Learning, 27*(3), 265–272.

Hilton, J., Robinson, T., Wiley, D., & Ackerman, J. (2014). Cost-savings achieved in two semesters through the adoption of open educational resources. *The International Review of Research in Open and Distributed Learning, 15*(2), 67–84. doi:http://dx.doi.org/10.19173/irrodl.v15i2.1700

Huntington-Klein, N., Cowan, J., & Goldhaber, D. (2017). Selection into online community college courses and their effects on persistence. *Research in Higher Education, 58*, 244–269. doi:10.1007/s11162-016-9425-z

Jaggars, S. S., & Xu, D. (2010). Online learning in the Virginia Community College System. *Community College Research Center: Teachers College Columbia University*, 1–47. Retrieved at https://ccrc.tc.columbia.edu/publications/online-learning-virginia.html

Johnson, S. G., & Berge, Z. (2012). Online education in the community college. *Community College Journal of Research and Practice, 36(*11), 897–902. doi:10.1080/10668920903323948.

Jung, I., Sasaki, T. S., & Latchem, C. C. (2016). A framework for assessing fitness for purpose in open educational resources. *International Journal of Educational Technology In Higher Education. 13*(1). 1–11.

Kimmons, R. (2016). Expansive openness in teacher practice. *Teacher College Records, 118*(9), 1–34.

Kvale, S. (2008). *Doing Interviews*. Thousand Oaks, CA: Sage.

Leah Meyer Austin Award (2018). Odessa College. *Achieving the Dream.* Retrieved from https://www.achievingthedream.org/resource/17271/2018-leah-meyer-austin-award-odessa-college

Leedy, P. D., & Ormrod, J. E. (2016). *Practical research: Planning and design.* Boston, MA: Pearson.

Lovett, M., Meyer, O., & Thille, C. (2008). JIME-The open learning initiative: Measuring the effectiveness of the OLI statistics course in accelerating student learning. *Journal of Interactive Media in Education, 2008*(1). Retrieved from https://www-jime.open.ac.uk/articles/10.5334/2008-14/

McGill, L. (2013). What are open educational resources? *JISC.* Retrieved from https://openeducationalresources.pbworks.com/w/page-revisions/24836860/What%20are%20Open%20Educational%20Resources

McTighe, J., & Wiggins, G. (2012). Understanding by design framework. Alexandria, VA: Association for Supervision and Curriculum Development. Retrieved from https://www.ascd.org/ASCD/pdf/siteASCD/publications/UbD_WhitePaper0312.pdf

Moustakas, C. E. (1994). Phenomenological research methods. Thousand Oaks, CA: Sage.

Musil, B. (2018, October). *Models supporting the adoption, use or sustaining of OER in higher education.* Paper presented at the Open Education Conference, Niagara Falls, NY.

Nakajma, M. A., Dembo, M. H., & Mossler, R. (2012). Student persistence in community colleges. *Community College Journal of Research and Practice 36*(8), 591–613.

National Center for Educational Statistics (2017). Retrieved from https://nces.ed.gov/globallocator/

Opening the Textbook: Open Education Resource in U.S. Higher Education (2017). *Babson Survey Research Group.* Retrieved from https://www.onlinelearningsurvey.com/oer.html

Orr, D., Rimini, M., & van Damme, D. (2015) *Open educational resources: A catalyst for innovation.* Retrieved from http://dx.doi.org.proxy.lib.odu.edu/10.1787/9789264247543-en

Pawlyshyn, N., Braddlee, D., Casper, L., & Miller, H. (2013). Adopting OER: A case study of cross-institutional collaboration and innovation. *Educause Review*. Retrieved from http://www.educause.edu/ero/article/adopting-oer-case-study-cross-institutional-collaboration-and-innovation

Peter, S., & Deimann, M. (2013). On the role of openness in education: A historical reconstruction. *Open Praxis, 5*(1), 7–14.

Petrides, L., Jimes, C., Middleton-Detzner, C., Walling, J., & Weiss, S. (2011). Open textbook adoption and use: Implications for teachers and learners. *Open Learning, 26*(1), 39–49.

Phelan, D. J. (2016). *Unrelenting change, innovation, and risk: Forging the next generation of community colleges.* Lanham, MD: Rowman & Littlefield.

Roberts, C. M. (2010). *The dissertation journey.* Thousand Oaks, CA: Corwin.

Salem, J. A. Jr. (2017). Open pathways to student success: Academic library partnerships for open educational resources and affordable course content creation and adoption. *The Journal of Academic Librarianship, 43*(1), 34–38. doi:https://doi.org/10.1016/j.acalib.2016.10.003

Senack, E. (2014). Fixing the broken textbook market: How students respond to higher textbook costs and demand alternatives. *U.S. Pirg Education*. Retrieved from

http://www.uspirg.org/sites/pirg/files/reports/NATIONAL%20Fixing%20Broken%20Textbooks%20Report1.pdf

Seidman, I. (2012). *Interviewing as qualitative research: A guide for researchers in education and social sciences.* New York, NY: Teachers College Press.

Shea, P., & Bidjerano, T. (2016). A national study of differences between online and classroom only community college students in time to first associate degree attainment, transfer and dropout. *Online Learning, 20*(3), 14–25.

Teaching Online Program (2013). *Virginia Community College System–Educational Technology Program.* Retrieved from http://edtech.vccs.edu/elet/top-model-idol/

U.S. Department of Education (2017). Federal pell grant annual data report. Retrieved from https://www2.ed.gov/finaid/prof/resources/data/pell-data.html

United Nations Educational, Scientific, and Cultural Organization (UNESCO) (2002). Forum on the impact of open courseware for higher education in developing countries. *Conference Proceedings Final Report.* Paris, France. Retrieved from http://unesdoc.unesco.org/images/0012/001285/128515e.pdf

VCCS Re-engineering Task Force II. (2013). Textbook costs & digital learning resources: Interim report. (Unpublished report). Richmond, VA: Virginia Community College System.

Why QM? (2018). *Quality Matters*. Retrieved from https://www.qualitymatters.org/why-quality-matters

Wiggins, G., & McTighe, J. (2011). *The understanding by design guide to create high-quality units.* Alexandria, VA: Association for Supervision and Curriculum Development.

Wiley, D., Williams, L., DeMarte, D., & Hilton, J. (2016). The Tidewater Z-Degree and the INTRO model for sustaining OER adoption. *Education Policy Analysis Archives, 23*(41), 1–12. Retrieved from http://dx.doi.org/10.14507/eppaa.v23.1828

Winitzky-Stephens, J., Pickavance, J. (2017). Open educational resources and student course outcomes: A multilevel analysis. *International Review of Research in Open and Distributed Learning, 18*(4), 35–49.

Wood, J. L., & Harris, F. (2015). The effect of college selection factors on persistence: An examination of Black and Latino males in the community colleges. *Journal of College Student Retention: Research, Theory & Practice, 16*(4), 511–535.

Xu, D., & Jaggars, S. S. (2011). The effectiveness of distance education across Virginia's community colleges: Evidence from introductory college-level math and English courses. *Educational Evaluation and Policy Analysis, 33*(3), 360–377.

Xu, D., & Jaggars, S. S. (2013). The impact of online learning on students' course outcomes: Evidence from a large community and technical college system. *Economics of Education Review, 37*, 46–57.

APPENDIX A

RESULTS OF QUANTITATIVE ANALYSIS STUDIES

Drop/Retention Rates	Success Rates	Persistence Rates	Common Final Exam
Significant lower drop rate in OER vs. non-OER courses (Wiley, Williams, DeMarte, & Hilton, 2016)	Significant lower failure rate in OER vs. non-OER business courses (Feldstein, Martin, Hudson, Warren, Hilton, & Wiley, 2012)	Significant positive moderate correlation between OER and student achievement in online history courses (Grewe & Davis, 2017)	Higher exam scores in OER vs. non-OER psychology course; no test for significance (Hilton & Laman, 2012)
Significant lower drop rate in OER vs. non-OER online/hybrid classes (Hilton, Fischer, Wiley, & Williams, 2016).	No significant difference in completion for math courses (Hilton, Gaudet, Clark, Robinson, & Wiley, 2013) Higher significant success rates in OER vs. non-OER business courses (Hilton, Fischer, Wiley, & Williams, 2016) Significant higher completion rates in OER vs. non-OER algebra course (Chiorescu, 2017) OER was not a significant factor for student success in 14 general education courses (Winitzky-Stephens & Pickavance, 2017)		No significant difference in exam scores for OER vs. non-OER statistics course (Lovett, Meyer, & Thille, 2008) No significant difference in exam scores for OER vs. non-OER chemistry course (Allen, Guzman-Alvarez, Smith, Gamage, Molinaro, & Larsen, 2015)

APPENDIX B

INFORMED CONSENT FORM & INTERVIEW PROTOCOL

Academic Outcomes: Comparison of OER and Publisher Content in Four Online Courses

The primary purpose of the study is to analyze student retention and success in four online disciplines, where students were placed in either an OER section or a non-OER section. The results focus on student retention and completion as well as feedback from the instructors.

Participation in this study will require 60 minutes of your time. With your permission, the interview will be audiotaped. The data will be later transcribed and analyzed. The tapes will be erased after transcription. Pseudonyms will be used in the report. The college you work for will be identified. Any information that can identify you will be kept strictly confidential.

You may choose not to answer any questions with which you are uncomfortable. You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the researcher. Your decision will not result in any loss or benefit to which you are entitled. You may benefit from the participation in this project by adding useful insights to your experiences and perceptions of teaching with OER course material or publisher content material.

All written records will be securely stored in a locked file cabinet belonging to the researcher for a period of five years.

If you have any questions or concerns you may contact the researcher at any time at dryan001@odu.edu or the principal investigator, Dr. Linda Bol, at lbol@odu.edu. If you have any questions about your rights or this form, then you should call Dr. Laura Chezan, the current chair for the DCOE Human Subjects Committee, at lchezan@odu.edu or 757-683-7055 at Old Dominion University.

The interview will start with demographic questions. Then I will ask you exploratory questions about your experience of teaching the OER content material or publisher content material, followed by the same questions about teaching with publisher content material or OER material. Please be candid in your responses. After you sign this consent form and with your permission, we will begin the interview.

Consent Statement: I have read this form. I understand that nothing harmful will happen if I choose not to participate. I know that I can stop my participation at any time. I voluntarily agree to participate in this study.

Participant Signature

Researcher Signature

Participant Printed Name

Researcher Printed Name

Date:

Date:

Demographic questions:

1. How many years have you taught at a community college?
2. How many years have you taught online?
3. What professional development training did you receive for teaching online?
4. What professional development training did you receive for instructional design?
5. How long have you been aware of OER materials?
6. How many semesters prior to spring 2018 have you taught courses using OER materials?

Open Educational Resource (OER) questions:

7. Before you started using OER, what were your perceptions of it (perceptions)?
8. How many hours did you spend getting the course ready for students for the online section using OER material (usage)?
9. Tell me how you aligned the course learning outcomes to the OER content material (usage)?
10. How was the OER content adapted (usage)?
11. In what ways did you utilize the content or technology support services provided by the college to support the OER course content (outcome)?
12. What do you think about the quality of the OER material (outcome)?
13. What student benefits did you observe when teaching the OER material (perceptions)?
14. What teaching benefits did you observe when teaching the OER material (perceptions)?

Publisher Content Questions

15. How many hours did you spend getting the course ready for students in the online section using publisher content material (usage)?
16. Tell me how you aligned the course learning outcomes to the publisher content material (usage)?
17. How was the publisher content adapted (usage)?
18. In what ways did you utilize the content or technology support services provided by the publisher to support the course content (outcome)?
19. What do you think about the quality of the publisher content material (outcome)?
20. What student benefits did you observe when teaching with the publisher material (perceptions)?
21. What teaching benefits did you observe when teaching with the publisher content material (perceptions)?
22. What were the drawbacks of teaching with publisher content material (perceptions)?
23. What was it like for you to teach both types of content material during the same semester (perceptions)?
24. Why did you volunteer for the study (outcomes)?
25. What else can you tell me about what it was like for you to teach both types of material (perceptions)?

VITA

Diane N. Ryan

Darden College of Education, Community College Leadership Program
Old Dominion University, Education Building, Norfolk, VA 23529

EDUCATION

Old Dominion University, Norfolk, VA
Ph.D. in Community College Leadership, May 2019

Western Illinois University, Macomb, IL
M.A. Speech Communication Education, August, 1985

Western Illinois University, Macomb, IL
B.A. Mass Communications, May, 1983

HONORS AND AWARDS

- Poindexter Award Old Dominion University CCL Program, 2019
- Administrator of the Year Tidewater Community College, 2018
- Faculty Innovation for Institutional Effectiveness, May 2015
- VCCS Excellence in Education Award for the TCC "Z" Degree, April 2014
- Tidewater Community College Exemplary Employee Award, April 1995

TEACHING EXPERIENCE

- Assistant Professor – Principles of Public Speaking, Introduction to Communication, English Composition & Rhetoric, Tidewater Community College, Virginia Beach, VA
- Instructor - Principles of Public Speaking, Introduction to Communication, English Composition & Rhetoric, Tidewater Community College, Virginia Beach, VA
- Adjunct Faculty – Principles of Public Speaking, Fisher Junior College, Duxbury, MA
- Instructor – Principles of Public Speaking, Spoon River Community College, Macomb, IL

PROFESSIONAL EXPERIENCE

- Dean of Humanities & Social Sciences, Tidewater Community College, Chesapeake, VA (07/2015 – present)